SITE: Smiths Farm
BREAK: 8.6
OTHER: 03

US Army Corps of Engineers ®
Louisville District

EPA United States Environmental Protection Agency | waste management division | Region 4 serving the southeast

Superfund 1st Five-Year Review Report
Smith's Farm Landfill
Brooks, Bullitt County, Kentucky


Leachate Treatment Plant


OU2 Landfill Upslope and Access Road


OU2 Landfill South Slope, Treated Discharge Location


Leachate Lift Station and Treatment Plant

Prepared For:
U.S. Environmental Protection Agency, Region IV

Prepared By:
U.S. Army Corps of Engineers, Louisville District

September 2001

Five-Year Review Summary Form

Site name: **Smith's Farm Landfill**			EPA ID: **KYD097267413**
Region: **04**	State: **Kentucky**	City/County: **Brooks, Bullitt**	
LTRA* (highlight): Y **N**		Construction completion date: **9/98**	
Fund/PRP Lead: **PRP**			*NPL status:* **Final 06/10/86**
Lead agency: **EPA, Region 4**			
Who conducted the review (EPA Region, state, Federal agencies or contractor): **US Army Corps of Engineers, Louisville District**			
Dates review conducted: From: **6/24/01** To: **7/24/01**			Date(s) of site visit: **7/24/01**
Whether first or successive review: **First Review**			
Circle: **Statutory** Policy		Due date: **30 Nov 2001**	
Trigger for this review (name and date): Five years from construction start of the OU2 landfill and leachate treatment system.			
Recycling, reuse, redevelopment site (highlight): Y **N**			

Issues:

A list of issues were identified. See attached report Section VIII: Issues.

Recommendations:

Recommendations are listed in the attached report, Section IX: Recommendations.

Protectiveness Statement(s):

All elements of the remedy selected in the Record of Decision for the Smith's Farm Landfill have been put in place, are functioning properly, and remain protective of human health and the environment.

Other Comments:

The issues noted during this review are not immediate threats to the protectiveness of the remedy. Once these items are investigated and corrected, long-term protectiveness, operation, and site safety will be improved.

James J. Rutherford for

Richard D. Green, Director
Waste Management Division

9/28/01
Date

Table of Contents

Tables

List of Figures

Appendices

List of Acronyms

ARARs	Applicable or Relevant and Appropriate Requirements
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
GPM	Gallons Per Minute
HASP	Health and Safety Plan
KDEP	Kentucky Department of Environmental Protection
KDWM	Kentucky Department of Waste Management
MCL	Maximum Contaminant Level
MSL	Mean Sea Level
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
O&M	Operation and Maintenance
OU	Operable Unit
RAL	Risk Action Level
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
USACE	U.S. Army Corps of Engineers

Executive Summary

The first five-year review of the Smith's Farm Landfill. Superfund Site in Brooks, Bullitt County, Kentucky State was completed in September 2001. The results of the five-year review indicate that the remedy is expected to be protective of human health and the environment. Overall, the leachate treatment system and landfill cap remedial actions were functioning as designed, and for the most part were operated and maintained in an appropriate manner. A few issues that do not immediately impact the protectiveness of the remedy were noted.

The protection of human health and the environment by the remedial actions at Operable Unit (OU) 2 is discussed below. Both the Health and Safety Plan and the Operation and Maintenance Plan are in place, sufficient to control risks, and properly implemented.

Operable Unit 2

The remedy at OU2 is protective of human health and the environment.The remedy at the Site currently protects human health and the environment because it eliminates the exposure pathways relative to surface soils, surface water and leachate water in the short term.

The landfill cap is effective at containing contaminants through preventing infiltration of storm water and preventing direct contact or exposure of landfill waste by humans and fauna.

The leachate collection and transmission system prevents migration of hazardous substances offsite or to streams or groundwater.

The leachate treatment system is effective in meeting the discharge limits established by the USEPA and the State of Kentucky for the site contaminants.

First Five-Year Review Report

for

Smith's Farm Landfill
Operable Unit 2
Brooks, Bullitt County, Kentucky

September, 2001

PREPARED BY:

US Army Corps of Engineers, Louisville District

for

United States Environmental Protection Agency
Atlanta, Georgia

Approved by: James D Kutzman for **Date:** 9/28/01

Richard D. Green, Director
Waste Management Division

Smith's Farm Landfill
EPA ID: KYD097267413
First Five-Year Review Report

I. Introduction and Purpose

A. General. During July and August, 2001, the U.S. Army Corps of Engineers, Louisville District (USACE), on behalf of the U.S. Environmental Protection Agency, Region 4 (EPA), conducted a Five-Year Review of the remedy implemented at Smith's Farm Landfill in Brooks, Bullitt County, Kentucky. This report documents the results of that review. The purpose of Five-Year Reviews is to determine whether the remedial actions at a site remain protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in Five-Year Review reports. In addition, any issues identified during the review will be presented, along with recommendations to address them.

B. Authority. This review is required by statute. Section 121 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), and Section 300.430 (f) (4) (ii) of the National Oil and Hazardous Substance Contingency Plan (NCP), require that periodic reviews be conducted at least every five years for sites where hazardous substances, pollutants or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure following the completion of all remedial actions.

This is the first Five-Year Review for the Smith's Farm Landfill. The trigger for this statutory review is the passage of 5 years since the start of construction of the OU2 remedy. All elements of the remedy for the site have been completed; the only on-going actions at the site are operations and maintenance activities intended to maintain the integrity of the remedy, and long-term monitoring to evaluate the effectiveness of the remedy.

C. Local Repository. This review will be placed in the site files and local repository for Smith's Farm Landfill. The repository is located at Ridgeway Memorial Library, located at 2nd and Walnut Street in Shepherdsville, Kentucky, 40165.

Note: Through out this report, text has been extracted, summarized, and/or edited from the following Smith's Farm Landfill Superfund Site documents:

- EPA Record of Decision (ROD) for Operable Unit (OU) 2 dated September 17, 1993;
- NPL Site Summary: http://www.epa.gov/region04/waste/npl/nplky/smifrmky.htm;
- ROD Abstract: http://www.epa.gov/superfund/sites/rodsites/0402059.htm;
- Site Operation and Maintenance Manual, Remedial Action (RA), OU2;
- Annual O&M Reports, 1999 and 2000, for OU's 1 and 2.

II. Site Chronology

Table 1 lists the chronology of events for the Smith's Farm Landfill site.

III. Background

A. Site Location. The Smith's Farm Landfill is located in Brooks, Bullitt County, Kentucky, approximately 12 miles south of Louisville, Kentucky (Figure 1, 1.1). The site is located within the Brooks, Kentucky USGS 7.5 Minute Topographic Quadrangle; its approximate coordinates are 38.0375° latitude and 85.733331° longitude.

B. Site Description. The 460-acre Smith's Farm Superfund Site is a former hazardous waste disposal area located in Brooks, Bullitt County, Kentucky. Land use in the area is predominantly rural residential, with areas of deciduous forest around the entire site. The site borders forested hills to the north, east, and west and a residential area to the south. In addition, intermittent streams flow along the north-central portion of the site and drain into the Unnamed Tributary of Bluelick Creek and, subsequently, into Floyd's Fork. The site includes an 80-acre area that was used for unpermitted disposal of drums containing hazardous waste for a period of approximately 30 years. It also includes a 37.5-acre landfill that was permitted by the State for the disposal of inert industrial waste from 1973 to 1989; however, the landfill had been used for disposal of industrial waste since the 1950s. The disposal activities in both areas of the site have resulted in contamination of onsite environmental media. In 1984, following investigations by EPA and the State, EPA performed an immediate removal of surface drums from the unpermitted disposal area. Also, in the 1980s, the site operator reportedly burned piles of wood debris to dispose of large volumes of scrap wood. In an attempt to smother the smoldering wood debris, the operator later buried the debris in the northern half of the landfill. Several attempts to smother the fires were not successful; subsurface thermal anomalies existed in the northeast and northwest corners of the landfill. Beginning in 1988, EPA conducted detailed onsite investigations, which revealed organic and inorganic contamination in environmental media in the vicinity of both disposal areas. For remediation purposes, the site was divided into two OUs. A 1989 ROD and a 1991 ROD amendment addressed containment of contaminated soil, sediment, ground water in the surficial aquifer, and drums in the vicinity of the unpermitted drum disposal area, as OU1. The OU2 ROD addresses landfill wastes, leachate, leachate sediment, surface soil, ground water, and surface water associated with the 37.5-acre landfill and other small, outlying areas of contamination onsite. The primary contaminants of concern affecting the soil, sediment, ground water, and surface water are VOCs, including benzene, TCE, and toluene; other organics, including PAHs, pesticides, and phenols; and metals, including arsenic, chromium, and lead.

C. Site History: The Smith's Farm property is very hilly and not suitable for farming or forestry; the hills have steep-sloped sides with little flat area between. The proximity of industries in and around Louisville, and the need of those industries to dispose of their wastes cost-effectively, resulted in the unpermitted and permitted disposal of industrial and commercial wastes in two (2) major areas and several smaller areas at the Site. Some of the Site's ravines served as disposal "ditches" for construction debris, old household appliances, auto bodies, unsalvageable metallic industrial equipment, used tires, used drums, drummed wastes, and uncontainerized liquid and solid wastes. The 37.5-acre landfill area, which was composed of a hilly ridge with a ravine on each side,

was permitted by the Commonwealth of Kentucky to accept inert industrial wastes from November 1973 to May 1989, although the landfill area had industrial waste placed in it since the 1950. The permit was not in effect continuously and several violations occurred. The landfill was operated by the property owner, Mr. Leonard 0. Smith, Sr., until his death in 1969, and by his son, Harlan Smith, until his death in 1978. The current landfill and property owner is Mrs. Mary Ruth Smith, whose nephew, Buddy Mobley, has operated the landfill.

In 1984, following several inspections by USEPA and Commonwealth regulatory personnel, an immediate removal of surface drums, which contained hazardous waste, from the unpermitted disposal area (the area addressed by Operable Unit One) was conducted by USEPA. The Smith's Farm Site was added to the National Priorities List in June 1986.

During the 1980's, the landfill owner contracted for the installation of a small leachate collection and recirculation system at the landfill at the insistence of the Commonwealth. Leachate lines of perforated plastic pipe were installed in ditches at the overburden/bedrock interface on the southeastern and southern sides of the landfill. The collected leachate went to a surge/collection tank and then to a large pump from which it was pumped up to the central part of the landfill where it was sprayed onto the surface of the landfill from several vertical plastic pipes. The system was used only intermittently and then, reportedly, was shutdown before the 1988-89 Operable Unit One Remedial Investigation because of air emissions problems and complaints from residents of the mobile home park to the south of the landfill.

Reportedly, also during the 1980's, the landfill operator, in an attempt to dispose of large volumes of scrap wood, set piles of wood debris on fire in the northeast and northwest quadrants of the landfill. Later the operator buried the smoldering wood debris in an attempt to smother the fires. The attempt to smother the fires was not completely successful and over the next few years the operator made subsequent attempts to smother the subsurface combustion by bulldozing the areas. During the 1990 Operable Unit Two Remedial Investigation, infrared aerial photography indicated that thermal anomalies (surface soil temperatures of 75-80 degrees Fahrenheit on a cool morning) still existed; one in the northeast and one in the northwest quadrant of the landfill.

In 1988, field activities for the Operable Unit One RI/FS occurred. The RI for Operable Unit One determined that leachate seeping from the permitted landfill contains several volatile organic compounds (i.e., chlorinated aliphatics, ketones, and monocyclic aromatics) and heavy metals. The Unnamed Tributary stream sediments are contaminated by extractable organic compounds (i.e., polycyclic aromatic hydrocarbons) and heavy metals which are attributable to releases from the permitted landfill, as well as the unpermitted drum disposal area. Soil samples collected from a location next to the landfill were also contaminated with extractable organic compounds.

The permit for the landfill expired on May 10, 1989. The Commonwealth of Kentucky determined that the permit should not be renewed because (1) a completed permit application had not been received (Kentucky Revised Statutes Section 224.855); (2) hazardous substances had been released from the permitted landfill and therefore remedial action to control the release(s) was required (Kentucky Revised Statutes 224.877); and (3) information required in order for the Commonwealth to re-evaluate the permit's renewal would be available only through a Site study comparable to a Superfund Remedial investigation (401 Kentucky Administrative Regulations

47:020 Section 5).

The nature and extent of the releases from within the general area of the formerly permitted landfill and the threat to human health and the environment posed by these releases has been determined. The potential for contamination of the deeper ground water by leachate from the Operable Unit Two formerly permitted landfill and the Operable Unit One unpermitted drum disposal area has been investigated and has been demonstrated to be insignificant due to the extremely low permeability of the underlying shale geology. Therefore, the deep limestone aquifer is not being addressed by the selected remedy in this Record of Decision.

D. Enforcement History. Although Operable Unit Two is being treated as a separate phase of the investigation and remediation of the Smith's Farm Site, the enforcement activities for both Operable Units are intertwined.

During the summer of 1984, general notice letters and information request letters were issued and the search for potentially responsible parties (PRPs) was initiated. During the spring of 1987, RI/FS special notice letters were issued to the PRPs. A 1984 removal, which was conducted at the area addressed by Operable Unit One by USEPA Region IV Emergency Response authorities, is the subject of an ongoing CERCLA Section 107 cost recovery suit. In March 1990, the Department of Justice (DOJ) on behalf of USEPA filed civil action No. C-90-0232-L(M) against the owner and four (4) other PRPs who sent waste to the Site. On February 7, 1992 four (4) of the Defendants filed a CERCLA-based suit against fifty-three (53) other PRPs in U.S. District Court, Western District of Kentucky at Louisville, attempting to recover past, present, and future remediation costs for both Operable Units of the Site. The remediation schedule for the Operable Unit One area is in the Remedial Action (RA) phase under a March 14, 1990 Unilateral Administrative Order (UAO) addressed to thirty-six (36) of fifty-seven (57) PRPs and according to a September 30, 1991 Amendment to the September 29, 1989 Operable Unit One Record of Decision (ROD). The UAO was amended three (3) times to incorporate schedule changes due to the accomplishment of the ROD Amendment. An Administrative Order by Consent (AOC) for a Remedial Investigation/Feasibility Study (RI/FS) of the Operable Unit Two formerly permitted landfill, and proximal Site areas, was signed by only one (1) of fifty-seven (57) PRPs on November 9, 1989. The RI/FS was completed in January 1992. Upon completion of the Operable Unit Two ROD, USEPA will give the PRPs an opportunity to perform the remedy. If the PRPs refuse to perform the remedy as set forth in the ROD, USEPA has the option to order compliance through a Unilateral Administrative Order (UAO) or to undertake to conduct the Remedial Design and Remedial Action utilizing Superfund money and later pursuing the PRPs for cost recovery under CERCLA Section 107.

Table 2 outlines the Smith's Farm Site's remedial history for OU1 and OU2.

IV. Remedial Actions

A. Remedy Selection. The Record of Decision (ROD) for the Smith's Farm Landfill Operable Unit 2 was signed on September 22, 1993. The remedial action objectives are to reduce or prevent the risk associated with direct exposure of humans and fauna to:

(1) landfill waste and contaminated on-site surface soils;
(2) contaminated, on-site surface waters and groundwater;
(3) contaminated, on-site stream sediments; and
(4) contaminated on-site leachate and leachate sediments.

The OU2 addresses the soil and sediment contamination as well as the groundwater and leachate contamination. Based on the Remedial Investigation, the Feasibility Study, the selected remedial action consists of the following components:

(1) excavating and consolidating wastes from the small areas of contamination in the landfill;

(2) recontouring and capping the landfill with a RCRA Subtitle C cap with surface drainage controls and a gas control system;

(3) excavating and extinguishing the subsurface landfill fire;

(4) installing and operating a leachate collection and multi stage treatment system for the shallow ground water;

(5) discharging the treated water to the Unnamed Tributary east of the landfill;

(6) installing perimeter fencing, lockable gates, and warning signs;

(7) monitoring groundwater OU2 wells semi-annually for five (5) years after construction is complete and thereafter annually for a period of twenty-five (25) years; and

(8) implementing institutional controls, including deed, ground water, surface water, and land use restrictions.

B. Remedy Implementation. The remedial design for the site was started by Law Engineering in June 1994. The plans called for construction of sediment removal, placement, and consolidation; the landfill cover system; run-on, run-off controls; gas control system; perimeter fence and warning signs; Gabion wall improvements to the Unnamed Tributary, leachate collection and groundwater interceptor system, and Leachate Treatment Plant. Construction was substantially completed in September 1998.

C. Performance Standards or Goals. The system was designed, and has been operated, to achieve performance standards identified in the ROD. Effluent guidelines and monitoring requirements were established in meetings and correspondence with KDEP. Chemical-specific soil cleanup goals for the excavation of outlying areas of contamination are based on achieving cancer risk levels of $10^{[-6]}$, and include PAHs 0.882 mg/kg and pesticides 33.94 mg/kg. Chemical specific cleanup goals for collected leachate and ground water were determined during the remedial design. Discharge limits for treated effluents are to meet the requirements of State and Federal surface water criteria. Effluent from the system is monitored at the discharge point to the Unnamed Tributary.

D. System Description and Operations. The PRPs have contracted with Law Engineering and Environmental Services, Inc. (Law) to perform overall project management and perform environmental operations and maintenance management activities for the entire site. Law has been the sole O&M contractor for this site to date. The work is being conducted in accordance with the OU2 Site and Treatment Plant O&M Manuals. System description and operations requirements for each component of the Site OU2 remedy are described below.

1. Landfill Cover System Description

The landfill cover system at the Site is a composite barrier that was designed and constructed to meet the performance criteria of the ROD. The function of the landfill cover system is to minimize infiltration and maximize clean run-off which will substantially reduce the amount of leachate generated.

Subsequent to placement of waste and contaminated soil within the limits of the landfill, the landfill surface was covered with clean soil fill and terraces formed in preparation for construction of the RCRA-type cap described below.

The ROD required that a RCRA-type cap and cover system be constructed over the limits of the previously permitted landfill. The landfill cover system includes: 1) diversion ditches to divert stormwater run-on away from the cap, 2) a groundwater interceptor drain consisting of a geotextile lined, stone filled trench with perforated piping to intercept and divert groundwater away from the landfill, 3) terraces to slow run-off velocities and divert run-off to collection channels, 4) stabilized stormwater drainage channels to convey stormwater off the cap, and 5) gas vents and gas venting geocomposite to provide controlled gas migration pathways and vent landfill gases.

The purpose of the landfill cover system is to control infiltration of rainwater, to divert surface water from the landfill, and to provide suitable soil in which to develop vegetation. In order to meet these goals, a RCRA-type cover system has been constructed over the former landfill. The system includes mechanisms for surface water management (run-off and run-on control), groundwater management, landfill gas management, and erosion control. These mechanisms act together to provide a stable and effective means of minimizing the production of leachate within the landfill.

The landfill cover was designed to extend beyond the known edge of waste. However, in several areas, the edge of the RCRA-type cover was advanced to a point past the edge of waste to cover known seeps and to improve constructability. The limits of the landfill cover are shown on Figure 2.

The landfill airspace has been increased by approximately 100,000 cubic yards to accommodate additional contaminated soil and waste. The increased airspace has been limited to the west side of the landfill.

The RCRA-type cover system which includes the following components was constructed over the landfill (see Figure 2.1 for typical section through the cover and Type A cover edge):

- Compacted fill - To protect geosynthetic cover materials from irregular surfaces of waste and provide adjustment to existing grades as necessary for positive drainage.
- Geosynthetic clay liner - To provide a barrier layer.
- Geomembrane - To block liquids from reaching waste.
- Geocomposite drainage layer - To remove liquids that percolate from the surface and become trapped above the geomembrane.
- Geosynthetic clay liner
- Vegetative soil - To support vegetation and prevent erosion of protective soil layers covering the geosynthetics

Following completion of the cover system, the cap and adjacent areas were seeded and mulched.

Landfill Cover Maintenance. Maintenance of the cover system consists of, but not limited to, the following tasks: Inspection of the entire cover system including fences and gates, gas control system, surface water drainage and erosion control systems, leachate collection system, infiltration gallery, and access roads; repair of erosion damage, rebuilding and regrading of settled areas to include general fill replacement, vegetative layer replacement, settlement monitoring, reseeding, mulching and fertilizing; mowing of cap and adjacent areas.

Results of the inspection, including any maintenance performed or required, are recorded on the Quarterly Inspection and Maintenance Form (Appendix E).

Routine inspection of the cover system and surrounding area provide indications of grass growth thickness and overall health. In areas of limited growth, additional fertilizer is used. As necessary, the cap and adjacent areas are be fertilized in conformance with the project specification and as required resulting from repairs.

The seed mixture was chosen for its low maintenance characteristics; however, periodic mowing is done by the on site maintenance personnel to maintain a grass cover height of approximately 6 to 24 inches.

The cap and adjacent areas are mowed on a regular basis during the growing season. The grass mowing season usually begins in late April and continues through September. All mowing is weather dependent. In times of drought and rain, the mowing schedule is adjusted to allow for fewer or additional mowings as the weather dictates.

There are obstacles at the Site which must be avoided during mowing operations. The obstacles include:

- Gas venting system risers, and
- Groundwater monitoring well

The cap is inspected for burrowing animal dens on a quarterly basis.

The cap is inspected for tree saplings and other vegetation that could damage the integrity of the cover system. The inspections are performed quarterly. Maintenance personnel remove as many of the trees and shrubs as possible, including the root system during inspections and prior to

mowing.

The site is inspected quarterly for erosion damage. Erosion that occurs on the capped area is repaired according to the specifications detailed in the design documents. Repairs to other areas are evaluated to determine the required repairs.

2. Surface Water and Storm Water Controls

The function of the surface water and storm water controls designed for the cap is to regulate surface water run-on and run-off to, and from, the site during all rain events. The proper operation and maintenance requirements of surface water controls is a major part of the Site O&M Plan.

The purpose of surface water management at the site is to reduce the amount of stormwater that makes its way to the landfill waste and to provide stable and adequate conveyance for stormwater removal from the site. Therefore, surface water control systems for the site have been established to divert stormwater from the surface of the RCRA-type cap and direct it to existing drainage ways. Existing drainage patterns have been maintained wherever possible.

Surface water control systems are shown on Figure 3, Surface Water Drainage/Erosion Control Plan.

Design flow is based on the 24-hour, 50-year storm event with a 1.5 factor of safety. This standard has been applied to conveyance structures on and adjacent to the cap, but not to previously existing structures and conduits.

Prior to initial grading activities, interceptor ditches were constructed along the west and north perimeters of the landfill (Ditches 9-10 and 18-19). These ditches were lined with turf reinforcement matting to control erosion and will divert run-off from both the cap and areas outside of the cap to the Unnamed Tributary to the east and to an existing drainage way to the southwest. Additional ditches were constructed south of the southern access road to the cap (Ditch 1-2) and along the south side of the cap (Ditches 3-4 and 4-5). These ditches were also lined with turf reinforcement matting. On the cap surface, collector ditches (Ditches 6-7 and 8- 7) carry surface water run-off from the west side of the cap south to the south perimeter ditch. The collector ditches were redesigned during construction due to the modified slopes resulting from revised final grading for increased air space. Turf reinforcement matting and energy dissipaters constructed of stone-filled Gabion baskets were also added to protect portions of the channel affected by slope transition until the sod became established.

On the east side of the cap, surface water flows easterly to the 3H:IV side slopes. Terraces on the side slopes direct the flow to sodded letdown ditches. The sodded letdown ditches carry the flow down the slopes and discharge into run-off ditches (Ditches I I- 1 2 and 21-22) or directly to the Unnamed Tributary. The run-off ditches are lined with turf reinforcement matting and revegetative matting, respectively.

In addition, a perimeter toe drain collects water from the cover drainage geocomposite. The toe drain is placed along the south and east sides of the landfill and discharges to the surface ditches.

Improvements have been made to the Unnamed Tributary to ensure that it has capacity for the 24-hour, 100-year storm event.

Erosion Control. The establishment of adequate vegetation is the primary means controlling erosion of the completed landfill cover. Appropriate fertilizer, seed, and mulch have been applied to the final cover as necessary to establish vegetation.

Erosion control measures have been established to protect channels and outlets from the long- term high velocities expected due to the steepness of the site. Erosion control for these areas include various ditch lining materials, such as turf reinforcement matting, revegetative matting, and sod; outlet control structures (generally riprap); and Gabions to protect the channel bank of the Unnamed Tributary.

Groundwater Diversion. In areas where the ground surface slopes toward the landfill boundary, a groundwater interceptor drain has been established consisting of a perforated HDPE pipe in a gravel trench. These areas occur along the south, west, and extreme north limits of the landfill as shown on Figure 4, Leachate Collection Plan. The groundwater interceptor discharges at the ground surface at two points: the extreme northeast and southeast corners of the landfill. The discharge points are protected by riprap aprons.

During the construction phase, approximately 1,000 feet of the groundwater interceptor was eliminated on the southwest side of the landfill as excavation of road cut for landfill access showed the last 1,000 feet to be unnecessary due to dense shale in the area. The groundwater interceptor now discharges to the perimeter storm water collection ditch at a higher elevation.

Maintenance to the surface water and storm water controls consists of the following tasks:

- Quarterly inspection of drainage channels and berms, repair or replace as necessary.
- Repairs include, but are not limited to, removal of debris, saplings, trash, silt build-up from channels, replacement of rip-rap and rebuilding of diversion berms.

The Quarterly Inspection and Maintenance Form (Appendix E) is used to record the results of the inspection.

The purpose of the fence and gate is to control access and prevent the entry of unauthorized persons onto the site. A six foot high, galvanized steel fence topped with three strands of barbed wire has been installed around the perimeter of the site. Warning signs have been placed on the fence at approximately 300 foot intervals. The fence is typically placed within the property boundaries. Figure 2 shows the location of the permanent perimeter fence.

Maintenance of the perimeter fence, attached warning signs, gates and gate locks consists of repairs necessitated by damage from vandalism, accidents and/or normal wear and tear. A quarterly inspection is conducted to determine the integrity of the fence and the required maintenance. The inspection is performed by walking the perimeter and noting any necessary repairs.

3. Passive Gas Venting System

The purpose of the composite cover system is to minimize the movement of liquids into the waste, however, composite cover systems may also trap gases formed under the cover by the natural decomposition of organic materials or from volatilization or chemical change of other contained wastes.

A passive gas venting system has been designed and constructed in the cover system to prevent damage to the cover. The system consists of vents located in the interior of the landfill to release the majority of the accumulated gasses and around the perimeter of the landfill to prevent gasses from migrating off-site through the subsurface. In addition, a geocomposite was placed beneath the geosynthetic clay liner along the terraces within the landfill limits and in other areas to aid in the movement of gas towards the vents.

Gasses which migrate towards the surface will migrate to the vents and be released to the atmosphere. The vents are spaced at approximately one per acre. Vent spacing has been determined, in part, by locations of proposed terraces. Where possible, vents were constructed on terraces, near the front edge, for ease of access. The approximate location of the gas vents are shown on Figure 5, Gas Control Plan. See also Photo 14 for a typical installation.

Limited maintenance is conducted on the passive gas collection system. Vents are inspected for damage and clogged, exposed piping; ponded surface water or vegetative soils settlement; and conditions of surrounding vegetation, however, Law and Operator indicated that no methane readings have been, or are currently, collected and recorded.

4. OU2 Leachate Collection, Extraction, and Transmission System

A perimeter leachate collection trench was constructed during the RA to collect leachate generated within the landfill. In addition, five leachate extraction wells were constructed within the landfill to collect leachate in suspected low points. Both the perimeter leachate collection trench and extraction wells direct the leachate to a lift station constructed for pumping the leachate to the treatment plant. The function of the leachate collection and conveyance system is to collect and convey the leachate from the extraction wells and seep locations along the toe of, and within both the OU1 and OU2 landfills.

Extending from the southwest corner of the landfill to the northeast comer of the landfill is a perforated 6-inch diameter high density polyethylene (HDPE) leachate collection line. The leachate collection line rests in a 2-foot wide trench extending at least 3-feet into shale. The leachate collection line is surrounded by non-calcareous stone which is wrapped with geotextile.

Leachate emanating from the landfill is collected by this line and flows by gravity into a 6" x 10" dual-contained HDPE pipe where it flows by gravity to the leachate lift station where it is pumped to the treatment plant through a 3" x 6" dual-contained HDPE pipe. This dual-contained pipe consists of an inner pipe carrying the leachate enclosed by an outer pipe to contain accidental releases of leachate.

There are also five (5) extraction wells located on the landfill cap. Each extraction well contains an air-driven pump which pumps perched ground water and leachate from the landfill where it flows by gravity (from four (4) extraction wells, and under pressure from one (I) extraction well) to the leachate lift station and continues to the treatment plant through the 3" x 6" dual-contained pipe. Piping from the extraction wells to the leachate lift station is also dual-contained HDPE. Subsequent to collection, the leachate is pumped to the treatment plant via a double-contained piping system. Figure 4 illustrates the location of the OU2 collection, and conveyance system. Figure 6 shows the leachate collection, pumping, and transmission system from the OU1 landfill to the OU2 Leachate Lift Station.

Accidental releases of leachate within the inner pipe of the dual contained piping flows by gravity along the outer pipe to leachate detection points. The leachate detection points consist of a 3-inch HDPE "Tee", stubbed 90-degrees from the outer portion of the dual-containment pipe. A 3-inch HDPE riser runs from this "Tee" to a flanged cap 6-inches above final grade. These leachate detection points are located between manholes. When the flanged cap is removed, an inspector can look down the 3-inch HDPE riser for visual evidence of leachate leaks within the dual-contained piping system. The Site Operation and Maintenance Manual requires all leachate detection points be inspected quarterly.

The five leachate extraction wells (Photos 22, 23), equipped with air-driven extraction well pumps, extract leachate into the perimeter leachate collection line. This perimeter collection line conveys leachate by gravity to the Leachate Lift Station. Leachate collected from OU- I is pumped through a force main from OU- I (Photo 31) to the Leachate Lift Station. Submersible pumps in the Lift Station then pump the leachate to the treatment plant.

Perimeter Collection Trench. The perimeter leachate collection trench was constructed along the east and south sides of the landfill cap to intercept leachate flowing along the soil/bedrock interface, as well as from within the landfill waste. Leachate will flow by gravity through the trench before discharging into the lift station. The perimeter leachate collection system was constructed of a single-wall, perforated, HDPE pipe within a stone and geotextile envelope. Cleanouts are provided along leachate collection and transport lines for ease of maintenance. In addition, interceptor trenches have been constructed to connect known leachate seeps with the perimeter leachate collection trench.

Extraction Wells. One extraction well was constructed in each of five areas estimated to be topographic low points, based on estimated pre-landfill topography. Due to elevations estimated from the pre-landfill topography, leachate and/or groundwater accumulating in the low points would not be expected to flow into the perimeter leachate collection system. A combination of gravity lines and force mains were constructed to convey the leachate recovered from the wells to the lift station through double-wall pipes located above the geocomposites and at least three feet below final grade.

Lift Station. A lift station (Photos 3,4,5,7) was constructed immediately adjacent to the southeast corner of the landfill to pump leachate recovered from the collection trench and extraction wells to the leachate treatment plant. The lift station has a retention storage capacity of approximately 1,000 gallons; two 30-gallon per minute (gpm), explosion proof pumps; and the

necessary level controls to transfer the leachate to the sequencing batch reactor (SBR) in the treatment plant.

5. Leachate Treatment System

The treatment plant has been constructed at the site as part of the remedial action of the Smith's Farm OU2 Landfill. Leachate recovered from the Smith's Farm OU1 and OU2 Landfills is treated by a combination of chemical and biological processes. This treatment reduces heavy metal and organic constituents so the treated leachate stream can meet the applicable discharge requirements. The treatment system contains the following components and unit processes:

- Biological Treatment Unit - A packaged Sequencing Batch Reactor (SBR) system biologically degrades the organic constituents in the leachate (Photo 34).

- Metal Removal (MR) Unit - A package system uses caustic and polymer to precipitate metals from the leachate and acid to neutralize the supernate liquid (Photos 36,37).

- Sludge Dewatering Unit - A filter press removes water from the sludge generated by the SBR and MR prior to sludge disposal (Photo 43).

- Air Stripping - A low profile air stripper removes the remaining air strippableorganics from the leachate stream (Photo 40).

- Bag Filters - A pair of bag filters operating in parallel removes particulate carryover from the air stripper to reduce plugging in the granular activated carbon filters.

- Carbon Polishing - A granular activated carbon filter removes the remaining traces of organics from the leachate stream prior to discharge to the Unnamed Tributary (Photo 41).

Sequencing Batch Reactor: Recovered leachate is treated biologically to remove organic compounds in a sequencing batch reactor (SBR) (Photo 34). Leachate is fed into the reactor where it is held for a specific period of time for biological treatment. The addition of oxygen and other nutrients, and the presence of the organics in the water promotes the growth of bacteria. These bacteria consume (biodegrade) the organics over time. The SBR process, which is a time/level controlled process, normally follows the basic steps of fill, react, settle, and decant.

The SBR packaged system consists of one reactor. The maximum design treatment capacity of the SBR is 28,800 gallons per day (or 20 gpm). Flow to the reactor is automatically shut offand diverted to the infiltration gallery when the high-high level switch in the SBR has been activated. Actual average leachate flow rate from both operable units is approximately 3 gallons per minute.

Operation of the reactor is automatically controlled by a process controller with high and low level switches. The initial high and low levels as well as internal controller settings (internal cycle times, aeration frequency and duration times, etc.) are specified and preset by the SBR supplier.

Each reactor cycle will produce sludge. The sludge is automatically pumped by a waste activated sludge pump into the sludge thickening tank (T-8-1). This process called sludge wasting is expected to occur during each reactor cycle. Sludge wasting occurs during the decant phase, with the duration automatically regulated by the process controller. The volume of sludge generated is dependent upon the amount of suspended solids(TSS), biological oxygen demand (BOD), and chemical oxygen demand (COD) present in the influent to the SBR system. Sludge solids are processed by the plate and frame filter press.

Metals Removal (MR) System. The packaged metal removal unit (Photos 36,37) uses pH adjustment, flocculation, clarification and sedimentation to reduce the concentration of metals in the leachate. The system consists of a large tank which is divided into a flash mixing zone, a flocculation zone and a clarification zone. In addition, the system utilizes three chemical sources: a 20 to 50 percent concentration sodium hydroxide storage tank (T-2-1-1), a 50 percent concentration sulfuric acid storage tank (T-2-1-3), and an anionic polymer day tank (T-2-1-2). The design throughput of the MR system is 28,800 gallons per day (or 20 gpm).

The metals are removed by raising the pH of the leachate to approximately 9.5. At this pH, the metal constituents become insoluble and form metal hydroxide compounds. These hydroxide compounds settle to the bottom, which allows them to be separated from the clarified water.

Based upon treatability testing, it is anticipated that only sodium hydroxide addition is needed to initiate the precipitation, flocculation and sedimentation of metals. The addition of polymer promotes more efficient settling by creating larger floc particles. From the first mixing chamber, the leachate overflows to the second mixing chamber where, during the slower mixing, an insoluble metal precipitate (floc) forms. Polymer is then added and mixed using a variable speed mixer to enhance large, heavy floc particle formation. The liquid and floc overflow into a clarifier where the heavy floc material settles to the bottom. The clarified liquid overflows to the third mixing chamber where final pH adjustment is performed using 50 percent sulfuric acid. The effluent pH will be controlled within the range of 6 to 9. After final pH adjustment, the treated leachate flows to the low profile air stripper feed tank. The solids that are collected in the bottom of the clarifier are periodically transferred to the sludge thickening tank (T-8-1) for dewatering.

Once the system is started and the pH adjusted at various stages of the process, the level in the clarifier and the volume of sludge removed are controlled by the Programmable Logic Controller (PLC).

Low Profile Air Stripper. The low profile air stripper (R-4-1) (Photo 40) is a packaged unit that uses air-water contacting to transfer volatile organic constituents from the influent water stream to the air stream. This contacting is accomplished on a series of aeration trays within the air stripper unit. Effluent from the MR system flows to the air stripper feed tank (T-3-1), which acts as an equalization tank to ensure a relatively constant flow to the air stripper. Effluent water from the air stripper is pumped to the carbon vessels (T-6-1 and T-6-2) for final polishing before discharge.

The low profile air stripper has a modular design capable of accommodating several aeration trays. The design allows the trays to be easily removed, cleaned, and replaced with minimal downtime. The design flow rate of the unit is 20 gpm.

The water enters near the top and flows horizontally across each tray and through a weir to the tray below. A pressure blower provides air for the aerating process. The air enters the bottom of the unit and is forced through openings in the trays, bubbling through the water to form "a surface of foam" which provides extreme turbulence and excellent volatilization. The overall effect is a multiple counter-current contact of water and air, with each tray having a cross-flow of water opposinga vertical flow of air. The effluent air stream does not require any treatment and is vented outside the building.

Sludge Thickening Tank. This tank is used to store and further thicken thesludge generated from both the SBR treatment process and the MR system.

The sludge thickening tank (Photo 35) provides the operator the ability to decant water from the settled sludge. Excess water in the sludge thickening tank is decanted when there is sufficient sludge volume to dewater (the tank should be at least half full). Decant valves at several liquid heights are used to decant the excess water. An 8-inch length of clear pipe, installed downstream from the decant valves, allows the operator to see when sludge is encountered so that the operator knows when to stop decanting. The decant water is discharged to the building sump where it is then pumped back to the SBR inlet. The decanting process thickens the sludge and reduces the volume of material to be dewatered. The sludge thickening tank is designed to increase the solids content of the sludge to approximately 2.5 - 4 percent solids by weight. The sludge is thoroughly mixed in the tank and the material is pumped to the filter press.

Sludge Dewatering System: The sludge dewatering system consists of a packaged filter press unit (Photo 43). The filter press consists of a number of polypropylene plates, each of which is covered with a polypropylene filter cloth. Diatomaceous earth is added to the filter cloth (asa pre-coat) before the thickened sludge is introduced to the unit. The filter plates are pressed together hydraulically and the sludge is pumped through the unit. Sludge is retained by the filter cloth and water is forced out through small holes in the press plates which direct the water out of the unit. The sludge is then removed by manually scraping it off the filter cloths at the completion of the press cycle. The filtrate water is directed to the building sump for further treatment. The filter press utilizes a fully automatic hydraulic closure system mounted on the filter press assembly. The hydraulic closure system consists mainly of a electro/hydraulic power unit, a double acting hydraulic cylinder and a hydraulic control.

The electro/hydraulic power unit is designed to open the press, close the press and maintain sealing pressure while feeding sludge at pressures up to 100 psi gauge pressure. The hydraulic control system is integrated into the filter press control panel and controls hydraulic pressure with a contact pressure switch with two snap-action contacts.

Compressed air is blown through the filter press at the end of the filtering process to purge the feed lines and dry the filter cake. The filter cake is then discharged into a hopper where it is collected prior to disposal at an approved facility. Toxicity Characteristic Leaching Procedure (TCLP) testing of the dewatered sludge is performed to determine regulatory status, i.e. whether it is classified as hazardous or non-hazardous waste for purposes of disposal.

Carbon Adsorption: The carbon adsorption polishing system consists of two steel vessels filled with granular activated carbon (Photo 41). Each carbon vessel is sized to treat a maximum flow rate of 75 gpm. The design flow rate of each vessel is 20 gpm. The carbon vessels are also capable of operating in either parallel or series should additional capacity or reduction in effluent concentration be required., Standard operating procedure at the Smith's Farm OU2 Landfill is to operate the carbon vessels in series. Periodic sampling of the effluent from the primary vessel monitors for breakthrough of organic constituents (which means the carbon no longer removes the constituents to non-detect levels) exiting the first vessel. When breakthrough occurs, the plant operator switches flow to the secondary vessel which becomes the primary vessel and calls the carbon supplier for replacement of the spent carbon vessel. The primary purpose of the system is to remove residual organic compounds in the treated leachate leaving the low profile air stripper. The system is designed to operate 24 hours per day with a pH between 6.0 and 9.0, and water temperature ranging from 50 to 68°F.

Instrumentation and Controls: The following section identifies the various instrumentation and control hardware associated with each major section of the leachate extraction and treatment system.

Main Control Panel - Extraction wells EW- I through EW-5 are air-driven and are enabled from the Main Control Panel (MCP) via solenoid valve FV-7-1. With hand switch HS-7-1-3 in the Auto position, the extraction well pumps continuously pump to the lift station sump. The Main Control Panel (MCP) provides monitoring and control functions for the leachate collection and treatment process in the treatment plant. An industrial computer on the MCP displays, in graphic format, the status of the treatment plant equipment (Photo 44). Graphics are color animated and follow the process and instrumentation diagram (P&ID) format. The industrial computer communicates with the Programmable Logic Controller (PLC) in the MCP on a real time basis and receives updates on the process.

An auto dialer is provided in the MCP that receives three alarm status conditions for MR chemical feed systems low level; Sludge thickening tank high level; and common process alarm.

The auto dialer is programmed to deliver these alarms to the plant operator's telephone number and the assistant operator's telephone number.

The MCP has motor starters, on-off-auto hand switches and "on" indicating lights for MR Feed Pump, Air Stripper Feed Pump, Air Stripper Sump Pump, Air Stripper Blower, and Building Sump Pump.

Alarm lights indicate conditions for the most of the process equipment. Additional indicators without alarms exist for the SBR reactor basin, SBR effluent tank, leachate lift station sump, and air stripper feed tank (high and low levels). PID controllers are provided for the flow control valves and flow meters associated with the MR feed and the air stripper effluent flow rates.

Leachate Treatment Maintenance and Recording: The Plant Operator is expected to be on site three days per week (M, W, F). Each day the operator visits the site, the normal maintenance activities associated with the equipment is performed. Adaily report is prepared each day the

operator is present, a separate log book is kept on all maintenance activities.

SBR - General maintenance includes: service all pumps, aeration devices, motors, actuators and valves in accordance with manufacturers recommendations provided in the Equipment O&M Manuals; check for unusual oil leakage from associated equipment; verify that all associated equipment (pumps, aeration devices, decanting mechanisms, level switches, etc.) are operable; check controller for proper timer and counter adjustments; verify proper operation of the nutrient feed systems and change out feed drums as necessary; remove any debris floating on the surface of the water in the reactors; hose down the sides (inside) of the reactors to remove any residues; inspect tanks for leaks.

MR System - The normal maintenance activities associated with the MR system performed 3 times per week include: servicing all process pumps, metering pumps, and motors; checking the operation of the mixer in the flash mix chamber and flocculation chamber; checking on the floc formation and settling rates in the clarifier; checking on the quantity of sludge generated and sludge blowdown schedules; checking on the timed sequence for sludge removal from the treatment system; manually removing light end material which may float to the top of the clarifier; and inspecting the MR system for leaks.

Air Stripper - The normal maintenance activities associated with the air stripper performed 3 times per week include: service all process pumps, motors, gaskets, and blower; checking the flow rate, influent and effluent pH, and temperature of the water; inspect the unit for leaks; checking for unusual oil leakage from associated equipment; verifying that all associated equipment (pumps, blower, level switches, etc.) are operable; checking pneumatic pressure drop and air flow rate for signs of inefficiency or clogging of the holes in the trays.

Sludge Thickener - The normal maintenance activities associated with the sludge thickener performed 3 times per week include: service all pumps and motors; checking for unusual oil leakage from associated equipment; verify that all associated equipment (pumps, decanting mechanisms, etc.) are operable; remove any debris floating on the surface of the water in the sludge thickener; hose down the sides (inside) of the sludge thickener to remove any residues; inspect tanks for leaks; decant supernatant and pump sludge to filter press as needed.

Sludge Dewatering System - The normal maintenance procedures associated with the filter press during regular operation performed 3 times per week includes: checking the level in the hydraulic fluid reservoir; checking the filter cloths for blockage and tearing; checking adjustments of the pressure control valves, flow control valves, pump regulators and signaling devices; checking for external leaks, damage and unusual equipment noise.

Carbon Filter - The primary maintenance required by the carbon filters is the replacement of the carbon in the vessels with fresh carbon, the flow routing changes associated with this procedure, and periodic checks for tank and piping leaks.

Operational and Maintenance Logs, Records, and Reports - A daily "Operations and Maintenance Routine Check" is utilized to ensure that necessary observations and tasks are

completed during each visit to the plant. The checklist is based on the equipment and processes in the plant system. In addition to the routine checklist, the Operator maintains a log book for entering routine and unusual operating conditions encountered in operating the plant system. The daily log is maintained in a journal with sequentially numbered pages. All entries are initialed by the operator making the entry. The log book is also used to record any changes in the operation of the treatment system.

Records of service, maintenance and repair indicate the downtime and cost required to perform the work. This information is used to develop historical data vital for planning purposes. Records are also used to find recurring trouble areas where improved maintenance or other appropriate action may be required. The following records are used in controlling and evaluating the total maintenance program including preventive and corrective tasks: Equipment Data Manuals, Service Records, Motor Service Records, and Spare Parts Records.

On-Site Analytical Data - The analytical program is designed to provide the Operator with data on which to base operational decisions. Routine analyses are run on-site by the plant operating staff. A table has been prepared which presents the sampling points, the analysis to be performed, the recommended frequency of analysis and the analytical methods to be used.

Results of all analyses performed are recorded on a daily basis in a summary form to providea convenient single source of plant operational data. These summary sheets are bound and filed in the permanent plant files. Work sheets used while running analyses are kept as part of the permanent plant records. These sheets are dated and the complete identification of each sample included with the calculations. All calculations are signed by the person performing the analysis.

Data is input into a database or spreadsheet on a daily or routine basis. This allows the data to be sorted by analytical parameter, date, sampling location, etc. Spreadsheets are sent to Law in order to prepare summary reports which are needed for the plant permanent files and for reporting to the Kentucky DWM and USEPA.

Summary of O&M. Operation and maintenance of the site is being conducted in accordance with the O&M Plans for Site OU2 landfill and treatment plant. System operations requirements for the Smith's Farm Landfill Include:

- Mowing the cap as necessary, inspection of the landfill cap and quarterly inspections of surface drainage system;
- Quarterly inspections of the pumping operations;
- Quarterly monitoring of leachate treatment influent, air stripper effluent, and effluent;
- Ongoing maintenance of the landfill cap; leachate collection/extraction and transmission system;
- Ongoing maintenance of the Leachate Treatment Plant (LTP)

OU2 cap system maintenance has generally been limited to routine mowing, periodic weed control and woody vegetation removal, fence repair, rodent control and occasional repair of stressed or eroded areas.

Groundwater Monitoring Network. Groundwater monitoring at Smith's Farm's OU2 is conducted in general compliance with the USEPA Region IV Environmental Compliance Branch Standard Operating Procedures and Quality Assurance Manual (ECBSOPQAM) dated February 1, 1991. As the shallow groundwater at the soil/bedrock interface is directly affected by the infiltration of storm water, the shallow wells may be dry during or following periods of low rainfall. Since the flow of leachate is also along the soil/bedrock interface, the primary mechanism of contaminant migration usually ceases or diminishes during periods of dry weather. The inability to collect groundwater samples at such times has not been construed as a problem.

Selection of Existing Groundwater Monitoring Wells - The groundwater monitoring program included collecting and analyzing groundwater samples from monitoring wells screening two distinct groundwater layers: shallow groundwater ranging from approximately three to ten feet below the ground surface and deep groundwater from within the New Providence Shale and the New Albany Shales at depths ranging from 26.5 feet to 225 feet below the ground surface.

It was determined that groundwater monitoring wells MW-16, MW-18, MW-19, MW-22A, MW-22B, MW-24A, and MW-24B, which were installed prior to the OU2 RA, would be utilized as part of the groundwater monitoring system. Monitoring wells, MW- I through MW-8, MW- 17, and MW-20 were decommissioned by American Environmental during the OU2 RA. Monitoring wells MW-23A and MW-23B, originally protected during construction, are no longer being used for monitoring.

Installation of New Groundwater Monitoring Wells - To monitor the flow directions and constituents within the groundwater in the vicinity of OU2, seven new Type II groundwater monitoring wells were installed. Six of the new groundwater monitoring wells (MW-25 through MW-30) are located around the perimeter of OU2 in locations believed to be pre-landfill topographic valleys, and the seventh monitoring well (BG-1) is a background monitoring well located upgradient from OU2. The locations of these new groundwater monitoring wells are depicted in Figure 7.

The new monitoring wells were constructed in accordance with the Well Installation and Initial Monitoring Plan dated June 1996 using a four-inch inner diameter (ID) stainless steel riser with five-foot screened intervals across the soil/bedrock interface to allow monitoring of the shallow groundwater. Continuous-wrap screen was used to allow for the future modification of the monitoring wells to recovery wells, if needed.

The filter pack for each well was installed extending from the boring termination depth to one foot above the well screen. After installing the filter pack, each well was surged with a surge block for approximately five minutes. Then the depth to the filter pack was checked and, if necessary, more filter sand was added. The filter pack was sealed with a two-foot thick bentonite seat and the monitoring well completed with grout extending from the bentonite seal to the ground surface. Well protection for each well includes a concrete well pad, a locking steel protective casing, and three-bumper posts around the perimeter of the well pad. The newly installed monitoring wells were considered developed after removing a minimum of five well casing volumes and when the pH, conductivity, temperature, and turbidity stabilized.

Groundwater Monitoring Procedures - Three groups of groundwater monitoring wells are used to monitor the groundwater around the perimeter of OU2 on an annual or semi-annual basis.

The groups are defined as follows:

Group A: MW-3 through MW-8 and MW-11 through MW-15; TypeII monitoring wells located in the immediate vicinity of OU I.

Group B: MW-25 through MW-30 and BG-1; Type II monitoring wells located in the immediate vicinity of OU2 that screen the soil/bedrock interface

Group C: MW-22A, MW-22B, MW-24A, and MW-24B; Type III and Type IVmonitoring wells located in the immediate vicinity of OU2 that screen the New Providence shale and the New Albanv shale

Group D: MW-18 and MW-19; Type II monitoring wells located downgradient of OU2 near the Unnamed Tributary that screen the soil/bedrock interface.

Group A wells are used for release detection in OUI, while Group B are used for release detection in OU2. Group D wells are sampled to monitor the groundwater down gradient of OU2 in the vicinity of the Unnamed Tributary, if a release is detected in Group B.

Table 3 presents the monitoring schedule for the groups.

Discharge Requirements. The treatment plant is not operated under a National Pollutant Discharge Elimination System (NPDES) permit. However, the plant is required to meet certain discharge guidelines which have been determined in concert with the U.S. EPA and the Kentucky Department of Environmental Protection, Cabinet for Natural Resources and Environmental Protection. The treatment plant discharges to the Unnamed Tributary which eventually discharges off-site into Bluelick Creek.

Effluent discharge criteria for the treatment plant are shown in Table 4.

During this first five-year review period, Law reported some operational problems and some minor maintenance issues with the landfill and Leachate Treatment Plant as discussed in the paragraph below. The cap and LTP units have functioned properly since the corrective actions. The estimated construction cost for the landfill cap, leachate/GW collection, transmission and discharge system from the Feasibility Study (FS) was $33.4 M. Actual cost was $15.5 M. Estimated cost of the Leachate Treatment Plant was $1.1 M. Actual cost was approximately $1.7 M. O&M costs ran about 9% lower than original FS estimate of $0.45 M (June 1994) during the first year (1999). Routine costs were less the following year. However, the installation of a pump station and force main to transfer leachate from OU1 to OU2 and surface drainage improvements on OU2 raised overall actual costs by $0.6 M (4 %) to $16.1 M in the year 2000. Operation and maintenance costs for the following years fluctuated but were at a level that would be considered in an acceptable expected range. Some additional costs were incurred in 2001 in the amount of $0.22 M to complete the surface drainage improvements. Thus the final actual costs increased to $16.3 M. Table 5 lists annual costs for the site. Projected estimated O&M costs through 2029 are estimated at $0. 425M per year.

D. Progress Since Construction of OU2. During the current five-year review period following start of construction of OU2, several improvements were made, problems encountered and the corrective actions taken, modifications/additions to the design of the LF cap, leachate

collection and transmission, leachate treatment, and disposal system.

1. Landfill Cover System. As a result of severe rain storms in 1999, a number of erosion repairs were necessary on both OU1 and 2 caps. The more urgent of the repairs were completed in June of that year. Repairs included replacing soil and reseeding in numerous areas on both caps; replacing soil and gravel within the roadway to OU 2 cap; removing soil, gravel and riprap for the roadway ditches and cleaning out the culverts. Primary modifications to the landfill cover system relate to the surface water drainage system. In calendar year 2000, the construction of drainage improvements on the landfill cap and adjacent areas of Operable Unit Two (OU 2) was completed. The work included:

- installation of textured HDPE geomembrane for lining of downdrains to toe of landfill slope;
- construction of concrete-filled cellular confinement system for lining of lower section of Downdrains 3 and 4;
- improvements to designated portions of upper section of main drainage way (MDW), including removal of existing riprap and debris, placement of fill in erosion gullies, regrading of the MDW, installation of turf reinforcement matting (TRM), and seeding;
- placement of select soil fill and installation of TRM to repair erosion gullies on the surface of the landfill cap and terraces, including terrace entrances to downdrains and ditches as indicated;

regrading of MDW at access road crossing and construction of concrete-filled cellular confinement system;

- reconstruction and relining of the southern section of the MDW and adjacent ditch including removal of existing riprap ditch lining and rock structures (rock check dam/spillway and Gabion energy dissipator), placement of soil fill, regrading of the ditches, regrading of adjacent slopes, and construction of concrete-filled cellular confinement system for lining of MDW and adjacent ditch;
- reconstruction of drainage ditch on north side of the landfill cap access road;
- reconstruction of drainage ditch on south side of the landfill cap access road;
- repair of landfill cap access road from paved road to top of southwest slope, including placement of specified dense graded aggregate mix for filling of erosion gullies and resurfacing of the road (Photo 9, 10), regrading of the road surface, (including crowning of road), placement of select soil fill and regrading of areas adjacent to road, and application of asphalt prime and seal coats;
- reconstruction of southeastern runoff ditch;
- reconstruction of drainage ditches in the upper northeast section of the landfill cap;
- reconstruction of the lower northeast perimeter drainage ditch;
- repair of access road in the northern upper area of the landfill cap;

reconstruction of a defined section of the existing Gabion wall on the west bank of the creek and placement of concrete grout in eroded areas beneath the Gabion wall;

- removal of accumulated sediment from inside the triple and double culverts under the paved road; and
- excavation and removal of accumulated soil, rock and vegetation from the various drainage channels and drainage structures.

2. Operable Unit 1 (OU1) Leachate Routing. Subsequent to those modifications made in 2000, a east to west OU1 leachate conveyance system was constructed to eliminate high trucking costs to transport this material to the primary lift station. The improvement consisted of the installation of submersible pumping, level controls, valves, fittings, piping and accessories at the

underground leachate storage tanks; installing approximately 2,600 linear feet of dual containment HDPE force main, fittings and appurtenances, and electrical work for routing of leachate from the existing underground leachate storage tanks at Operable Unit One (OU 1) to the existing leachate lift station at Operable Unit Two (OU 2). The plan is shown in Figure 6.

3. Leachate Treatment Plant. No improvements or major repairs have been made since construction. Minor changes (non-specified) in operating procedures are constantly reviewed to enhance LTP performance.

4. Operational Changes. Recovery Well Number 5 was permanently inactivated with USEPA's concurrence in April, 1999.

5. O&M: The focus in 2000 and 2001 has been on meeting the O&M Plan requirements, but also ensuring that cost savings are made whenever possible. The current philosophy of managing OU1 and OU2 is to optimize the O&M and thereby reduce the lifetime cost.

V. Five-Year Review Process

The Smith's Farm Landfill Site five-year review was conducted by the Army Corps of Engineers, Louisville District for USEPA, Region V. The Remediation Project Manager for the site is Mr. Antonio DeAngelo. The following team members from the Corps of Engineers assisted in the review:

- Al Scalzo, P.E., Environmental Engineer
- Richard Kennard, Project Geologist
- Lindsey Lien, Process Engineer
- Sandra Frye, Regulatory Specialist

The five-year review consisted of the following activities: a review of relevant documents (see Appendix A); interviews with USEPA RPM, State of Kentucky Environmental Project Manager, and concerned citizens; representatives of the site Environmental Project Management and Operations and Maintenance Contractor (LawGibb Group); and a site inspection. In addition a notice regarding the forthcoming review report will be placed in the local newspaper (Pioneer News). The final report will be available in the information repository (Ridgeway Memorial Library.) Notice of completion will be placed in the local newspaper and local and state contacts will be notified by letter.

VI. Five-Year Review Findings

A. Interviews. The following individuals were contacted by letter and phone as part of the five-year review:

1. The Honorable Kenneth Rigdon, Bullitt County Judge Executive
2. Rick Hogan, Superfund Branch, Kentucky Division of Water Management (letter)
3. Mr. Antonio DeAngelo, USEPA Region IV Remedial Project Manager

The Honorable Kenneth Rigdon, Bullitt County Judge Executive, Shepherdsville, KY was initially contacted in August 2001 and notified that the Five Year Review was being conducted. Mr. Rigdon and other County officials or stakeholders were asked to clarify or expand on the following various points of the Remedial Action for Smith's Farm:

- What is your impression of the project? (general sentiment);
- What effect have site operations had on the surrounding community?;
- Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.;
- Are you aware of any events, incidents, or activities at the site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details.;
- Do you feel well informed about the site's activities and progress?;
- Do you have any comments, suggestions, or recommendations regarding the site's management or operation?;
- Do you have any knowledge of changes in State laws and regulations and present and prospective land uses and restrictions or any water quality, hazardous waste, or environmental health issues that may impact protectiveness to human health and the environment?;
- Have there been any complaints, violations, or other incidents related to the site requiringa response by your office? If so, please give details of the events and results of the responses.; and
- Are you aware of any shortcomings in current site operations? Please elaborate, noting which inadequacies, if any; currently prevent the remedy from being protective.

"Bullitt County Judge/Executive Kenneth Rigdon received correspondence regarding the Superfund 5-year Review for Smith's Farm Landfill at Brooks, Kentucky in Bullitt County. Judge Rigdon has not received any complaints or concerns from the community regarding the site or its operation, vandalism, or any adverse effects it has had on our community."

Mr. Hogan: Kentucky Division of Waste Management (KDWM), Project Manager of the Environmental Compliance Division. Mr. Hogan was initially contacted in August 2001 and notified that the Five Year Review was being conducted. Mr. Hogan described the current status of the site, and O&M issues including permits and long-term monitoring. During the course of the review, Mr. Hogan participated in an interview to clarify or expand on the following various points of the Remedial Action:

- What is your impression of the project? (general sentiment) "***The project was well done.***";
- Have there been routine communications or activities (site visits, inspections, reporting activities, etc.) conducted by your office regarding the site? If so, please give purpose and results. "***Yes, we inspect the site once or twice per year and receive an annual report. Erosion has been an ongoing problem, but these problems have been addressed in a timely and effective manner.***";
- Have there been any complaints, violations, or other incidents related to the site requiringa response by your office? If so, please give details of the events and results of the responses."***No***";
- Do you feel well informed about the site's activities and progress? "**Yes**";
- Are you aware of any shortcomings in current site operations; noting which inadequacies, if any,

currently prevent the remedy from being protective. "***No***"; and

• Do you have any comments, suggestions, or recommendations regarding the site's management or operation?"***No***"

Mr. Antonio DeAngelo, EPA Region IV Remedial Project Manager. Mr. DeAngelo was contacted in June 2001 during the initial planning phase for this Five-Year Review; dialogue took place prior to the site visit, and was followed by additional discussion during preparation of the report. Mr. DeAngelo provided background information on the Smith's Farm Superfund Site,a history of site activities, and a list of potential contacts having knowledge of site activities. Mr. DeAngelo also provided extensive documentation that is maintained in Region IV's Atlanta offices as part of the Deletion Docket and CERCLA Administrative Record for the Site.

B. Site Visit/Inspection. The Five-Year Review site inspection for the Smith's Farm Landfill Site held on July 24, 2001. The site visit began with a meeting at the Leachate Treatment Plant, which included an overview of the review process, regulatory issues, operational status, and interviews with Mr. Rob Bocarro, Ph.D., Environmental Project Manager, LawGibb Group; Mr. Eddie Taylor, on-site operation and maintenance; Jason Ross, LawGibb Group; David Miller, Ford Motor Co. The list of USACE and PRP personnel who participated in the meeting is provided as Appendix B to this report. Weather for the site visit was bright and very hot.

During the site visit, the following features were inspected or observed: the OU1 and OU2 landfill caps and surface drainage system, the leachate collection and transportation system, leachate treatment plant, treated leachate discharge system, and general site conditions. In general, the leachate collection, transportaton, treatment, and discharge system was found to be operating and functioning properly. A summary of the inspection findings is presented below. Refer to Appendix C for the site inspection checklists that detail the inspection findings.

1. Landfill Cap. Measurable precipitation of about 2.5-inches had been recorded two days prior to the inspection. The landfill cap vegetative growth had been mowed only once this season because of near drought conditions, but this did not affect the visual inspection of the cap and adjacent areas.

The cap was observed to be in good condition. The vegetative cover was thorough and relatively abundant (Photos 13, 14). There were several large areas with sparse vegetation (Photo 16), but no woody plants or shrubs were observed.

Due to the slope of the landfill and the strategic location of ditches/terraces (Photo 18), there was no evidence of ponding on the cap. The terraces slow down the velocity and intercept the runoff and directs it to lined letdown channels (Photos 2, 17). There also was no evidence ofrodent burrowing, cracks or surface erosion. On-site operator indicated that Site Management is notified of any vegetative distressed or eroded sections of the cap and terraces needing repair when they exceed several inches in depth or several square feet in areal extent and repairs are made as part of warranty agreements with a subcontractor by backfilling with equivalent cap material and reseeding with equivalent seed mix, mulching and watering. Repairs are usually pursued on an as-needed basis but usually in the spring or fall to facilitate the necessary revegetation. Since there is on going activity at this site, repairs to the cap are required on a continuing basis. Eroded portions of

terraces are repaired immediately as conditions allow.

There was no evidence of geosynthetics damage over the capped areas inspected and no bulging. No slope instability was visible although some gas vents and protective bollards on the landfill were observed to be tilted (Photo 25). Law explained that vent pipes and bollards were not set during construction specifically for monitoring movement of the landfill cap. Instead, concrete monument bench marks were installed and are surveyed for this purpose (Photo 19).

Letdown channels descend down the steep south slope which collect runoff by the terraces. These channels are lined, rip-rapped and grouted and in good repair (Photo 2, 17). It was apparent that the shallow channels on the east and west perimeter had recently been repaired and improved (Photos 9, 20,26).

The entire site is securely fenced, however, two locations along the south perimeter were damaged due to fallen trees. Law said these sections will be repaired as weather conditions improve. Gates are locked and warning signs are posted along the entire chain-link fence alignment and access roads around and on the site are in good condition (Photos 10, 13).

2. Leachate Treatment Plant and System. The leachate treatment system appeared to be operating and functioning properly. The LTP was constructed in 1998 so is fairly new. Visual inspections of the treatment interior showed no signs of wear. The interior and all equipment was clean painted and well maintained (Photos 33-44). Law stated that the treatment system had not experienced discharge limit concentration exceedences except for two occasions in November, 2000 when excess sludge build-up in the metals precipitation unit caused abnormally high concentrations of VOC's to be released from the sludge, subsequently travelingthrough the plant. This situation was corrected. Mr. Bocarro stated that most of the ongoing, day-to-day tasks and activities were operating adequately and the facility was being operated in accordance with the Revised September 1, 1999 Operation and Maintenance Manual. The O&M Manual was readily available in the office and included as-built drawings, maintenance logs, sampling and analysis plan, site-specific safety and health plan, and OSHA training records. A copy of the Treatment Plant O&M Manual was reviewed for this report.

VII. Assessment

A. Data Review

A review of available records and monitoring reports through December 31, 2000, indicates that approximately 3.05 million gallons of leachate from OU2 have been treated since the plant O&M phase began January 28, 1999. Leachate from the OU1 landfill was collected in 2-10,000 gallon tanks and hauled off site between September 1995 and October 2000. Leachate generated based on 1999/2000 data is approximately 40,000 gallons per year. In October 2000, a force main was installed which allowed leachate generated by OU1 to be combined with OU2 leachate for treatment at the OU2 plant. Data was not available to estimate total contaminant mass removed during treatment.

The flow rate and several of the primary contaminant concentrations in the leachate are approximately an order of magnitude below the levels the OU2 treatment facility was initially designed to treat as summarized in Table 6. Based on 1999 and 2000 data (2001 data were not available), the contaminant concentrations appear to be decreasing slightly, with natural variation in concentrations. The difference in contaminant concentrations between the two operable units has not been monitored directly. The operators report that contaminant concentrations increased following the addition of the OU1 leachate stream to the treatment plant. The influent data for the combined flow to the plant was not available. However, at the present time most compounds still remain above discharge standards. The data show that the treatment system is currently removing contaminants to below detection levels. A review of the sampling information contained in the 1999 and 2000 annual reports shows that the treatment system has been effective at removing contaminants below maximum contaminant levels (MCLs).

B. Trend Analysis

The operators confirmed the Health and Safety Plan (HASP) that it is in place and sufficient to control risks at the site and is being properly implemented. The remedial action objective of preventing direct contact or ingestion of contaminated soils and leachate continues to be met by the intact cap. Monitoring results show decreased concentrations of contaminants at collection/LTP influent points which indicates that contaminant loading to the plant has decreased (see Table 7 and Trend Figure 9). Contaminant levels are falling at an unpredictable rate, however. And there is uncertainty as to whether achieving restoration will be accomplished within the ROD project time frame of 30 years. The Record of Decision for groundwater (OU2) required a ban on installation of domestic water wells and continued monitoring of the landfill cover system by analysis of groundwater and leachate samples. The deed restrictions pertaining to domestic water wells has not been implemented but the required monitoring has been implemented. Monitoring results indicate the LTP is meeting effluent discharge levels as referenced in Table 4 and Table 10.

C. ARAR Review.

Smith's Farm (Brooks) CERCLA NPL site ARAR Review. An ARAR review was performed for the site in accordance with the EPA guidance document, "Comprehensive Five-Year Review Guidance," EPA 540-R-01-007, OSWER No. 9355.7-03B-P June 2001.

Documents provided for review of ARAR analysis were limited to:

1. Record of Decision, September 17, 1993
2. Commonwealth of Kentucky Natural Resources and Environmental Protection Cabinet, Department for Environmental Protection letter July 10, 1997 from Jack A. Wilson Director, Division of Water to Nathaniel Peters, II Ph.D., P.E, Law Engineering and Environmental Services, Incorporated Re: Smith's Farm Operable Unit 2.
3. United States Environmental Protection Agency, Region 4, July 6, 1998 letter to Mr. R. Daniel Lopper, P.E. et. Al. Law Engineering and Environmental Services, Inc
4. Commonwealth of Kentucky Natural Resources and Environmental Protection Cabinet, Department for Environmental Protection letter March 29, 2000 from Michael V. Wech, Manager

Hazardous Waste Branch to Mr. Victor Doritis Re: Smith's Farm Claim for Exclusion from the 1999 Hazardous Waste Assessment.

ARARs Identified in the ROD Requiring Evaluation* During the Five-Year Review:

401 KAR 34:060, Sections 1,8,9,12 – Ground Water Protection

No actual ground water protection standards were called out specifically as a remediation goal with a definitive endpoint, however ground water criteria were referenced in two sections of the ROD, section 7.6.4 (pg 92) and section 9.2.2 (pg 115). Both discussions address monitoring programs and evaluation with a later determination on the appropriateness of any warranted additional corrective action. Reference #3 above (letter dated 7/6/98) did not address any groundwater monitoring requirements, but was rather restricted to monitoring and reporting requirements for the leachate treatment plant.

401 KAR 34:070 and KAR 47:040 – Closure and Post Closure*
401 KAR 34:190 – Tanks*
401 KAR 34:230, Sections 6,7,8,9 – Landfills*
401 KAR 34:240, 50:025, 51:010, 51:052, 52:010, 63:005, 63:010, 63:020, 63:021 – Air pollution and fugitive emissions control requirements*

401 KAR 5:005 – Permits to discharge sewage; industrial and other wastes; definitions

Reference #2, (letter 7/10/97) indicates permit requirements were in fact waived, contingent on effluent criteria in the letter's attachment.

401 KAR 5:026 - :035 - Kentucky's Surface Water Quality Standards

While water quality standards were in fact defined in the ROD as ARARs, themajority of the effluent discharge criteria were ultimately established by the State of Kentucky in the 7/10/97 KDEP letter. Aside from the risk-based numbers for eleven (11) constituents identified in Table 9.0 c (pg 113) of the ROD, an additional twenty (20) constituents (Table 10) were added by the State. The effluent limits presented by the State for semi-volatile and volatile compounds appear to have been set at a default value of 5 ug/lwhich likely reflect analytical method detection limits at the time these criteria were established. Since the receiving surface water stated in the ROD is still not identified specifically in the State surface water designated use provisions (401 KAR 5:026), it is not possible to assign specific water quality based standards for the various parameters identified.However, Bluelick Creek drains to Floyds Creek which drains to the Salt River. Designated uses assigned to Floyds Creek include warm water aquatic habitat, primary contact recreation and secondary contract recreation. The Salt River designated uses include those defined for Floyds Creek and also includes domestic water supply. Effluent limits defined in the 7/10/97 KDEP letter generally meet or exceed water quality standards promulgated by the State of Kentucky (401 KAR 5:031) for the majority of designated usesapplicable to Floyds Creek and the Salt River, however since the decision logic for the development of the effluent parameters could not be determined, any general statements regarding compliance with State Water Quality

Standards, as *promulgated currently,* can not be made. With very minor exceptions, the treatment plant has consistently met the discharge criteria defined in the 7/10/97 KDEP letter.

401 KAR 34:060 sections 10 and 11 – compliance monitoring programs and corrective action programs

Since corrective action criteria were not explicit in the ROD, follow-up compliance monitoring and corrective action will continue to be evaluated by EPA and the State of Kentucky under the monitoring and reporting provisions of operations and maintenance protocols defined in the appropriate remediation documents (see ROD pg 92: Sections 10 and 11 of 401 KAR 34:060).

KSR 262 – Soil and Water Conservation requirements*.

To-Be-Considereds (TBCs)

Maximum Contaminant Level Goals

MCLGs are non-enforceable levels that fall into the ground water monitoring and corrective action provisions discussed earlier.

Location-specific and action-specific TBCs* - well drilling, well installation etc.*

RCRA Land disposal Restrictions (LDRs)*

RCRA Proposed Subpart S (55 FR 30798-30884) Corrective Action Levels*

*Per EPA Guidance, only those ARARs that address risk posed to human health or the environment need be reviewed. Other ARARs listed in the ROD and not reviewed in this five-year review were location- and action-specific requirements that were germane to the construction and construction operational activities of the landfill, leachate treatment, support structures and sediment removal etc. Those ARARs were not considered pertinent to evaluating the protectiveness of the remedy from an on going operation and maintenance perspective. Such ARARs included landfill cap design, tank design and air quality (fugitive emissions) relative to construction activities, OSHA standards, groundwater monitoring as well as Fish and Wildlife, Endangered Species and Wetlands Protection.

KPDES Regulations and Kentucky Water Quality Standards: EPA five-year review guidance requires a comparison of standards identified in the ROD against current standards. If a current standard is more stringent than the previous standard, the review process continues utilizing standards originally identified in the ROD as well as those current standards that are more stringent than those in effect at the signing of the ROD. To this end, as defined in the June 2001 EPA Comprehensive Five-Year Review Guidance (EPA 540-R-01-007) Exhibit G-1 (pg. G-4), it should be pointed out that there have been 2 federal actions pertaining to landfills under the Clean Water Act. On January 19, 2000 (65 FR 3008) EPA promulgated final effluent limitations guidelines (ELGs) for RCRA Subtitle C and RCRA Subtitle D landfills. Further, on October 30, 2000 (65 FR 64746) EPA reissued the Multi-Sector General Permit (MSGP) for discharges of storm water associated with industrial activity (see 40 CFR 122.26). Landfills are addressed under Sector L of that *federal* general permit for storm water. While it is clear from the applicability sections of both regulations that "inactive" landfills addressed under the National Contingency Plan (NCP) are not directly

covered under the scope of the regulation, these newly promulgated standards may be relevant and appropriate under the ARAR analysis. It should be further stated that these are federal actions under the CWA and that the State of Kentucky is fully authorized under the CWA to implement all permitting programs. The existing analytical parameter list for the Smith's Farm site could be compared with the ELG (40 CFR 445) parameter list as well as the parameter list identified under Sector L of the MSGP, or existing State storm water program, to determine if expanding the current monitoring program would enhance protectiveness to the site activities. Tables 8, 9 and 10 are presented for just such a comparison.

Table 8 represents EPA *technology based* standards (versus water quality based standards) promulgated under 40 CFR Part 445 – Landfills Point Source Category (65 FR 3048, Jan. 19, 2000). When evaluating the fourteen (14) parameters in Table 8 and comparing to those listed in Table 10, it is evident that four (4) of the Table 8 parameters are found in Table 10 (phenol, arsenic, chromium, and zinc). All 40 CFR 445 defined parameters have higher effluent values than those currently in place at the Smith's Farm effluent treatment plant, but no ROD or KPDES criteria for BOD_5 or TSS were found in any communications reviewed. The remaining ten (10) Table8 parameters were not listed in the ROD or any State of Kentucky communication letters. These ten (10) parameters may warrant incorporation into existing monitoring and reporting requirements to reflect treatment plant performance on other chemical groups not indicated in the ROD or other State imposed conditions.

Regarding the Multi-Sector Storm Water General Permit (MSGP) (60 FR 50804, Sept. 29, 1995). Sector L, *Storm Water Discharges Associated With Industrial Activity From Landfills, and Land Application Sites*, the industries covered by this sector were required to monitoring the following parameters in storm water run off.

The regulated parameters are an abbreviated list of those defined in Table 8, 40 CFR 445.10. From an applicability perspective, the parameters in Table 9 would apply to facilities subject to the provisions of 40 CFR 445.10. These parameters may be applicable to any ongoing storm water-monitoring program conducted at the Smith's Farm Site.

Regarding specific compliance monitoring of the effluent at the Smith's Farm, a letter dated July 10, 1997, from the State of Kentucky (KDEP) to Law Environmental was reviewed. It appears a compliance monitoring program and matrix was proposed and agreed upon by the appropriate parties. These parameters as well as those originally proposed in the ROD are identified in Table 10.

Compliance with ARAR Summary Statement: A review of standards identified as ARARs in the ROD was completed as well as an evaluation of new standards promulgated since the signing of the ROD. Two new federal regulations under the CWA have been promulgated since the ROD was signed. Effluent limitation Guidelines for Landfills (40 CFR 445) and the storm water general permit regulations for industrial activity (September 29, 1995, reissued March 30, 2000), specifically Sector L (of the federal multi-sector general permit). While these new regulations are not directly applicable to site operations, they may be considered relevant and appropriate and could be further evaluated for incorporation into site operations. Additionally, the State of Kentucky is a fully authorized CWA State, and therefore any State adoption of these federal regulations would override the federal

program.

Based upon the data provided, the leachate treatment system discharge limits for site contaminants as developed with EPA and the State of Kentucky are being met.

ARAR Compliance Recommendation: All parties may wish to evaluate potential protectiveness benefits associated with the recently promulgated ELG and storm water general permit provisions associated with the operation of landfills.

D. Remedy Operation

1. Landfill Cap

The landfill cover system appears to be effective in isolating waste and contaminants. There is some minor erosion/rutting on the cap, but repairs are made and this situation does not affect the performance or the integrity of the cover.

2. Leachate Collection and Metering

Leachate from the perimeter of the capped OU2 landfill is collected in a lift station at the bottom of the slope. Flow from the OU1 landfill is collected in the two tanks as discussed earlier and transferred to the central lift station prior to discharge to the LTP. The flow is metered in the leachate-metering vault. A single dual containment pipe conveys the flow from the metering pit to the influent tank in the treatment building. The annual amount of leachate treated was 1,527,743 gallons in 1999 and 1,517,339 gallons in 2000. The corresponding daily average flow rates from the landfill would be 2.91 gpm and 2.89 gpm, respectively.

3. Leachate Treatment

The leachate is pumped from the lift station to the sequencing batch reactor and nutrients are added. After the first basin is filled, the unit is aerated, settled, and the decanted liquor pumped to the metals removal unit. Sodium hydroxide and polymer are added ahead of the flocculation tank. The pH is raised from approximately 7.0 to between 10.5 and 11.5 to enhance precipitation of the metals from solution and subsequently settled out in the lamella clarifier. After removing the metals from the leachate, the pH is readjusted to near neutral, using sulfuric acid. The leachate is pumped to the low profile air stripper, where volatile organics are stripped out. The air stripper effluent is pumped through two bag filters operating in parallel to allow removal of any residual particulates that might foul the granular activated carbon (GAC) polishing filters. The GAC units act as a final treatment step to remove the semivolatile and volatile organics down to the stringent discharge standards.

4. Chemical Addition

Chemical storage tanks and metering pumps dispense each chemical. Secondary containment and safety showers are provided. Material safety data sheets are kept at the plant and the tanks are

labeled.

5. Control

Level controls, alarms and auto-dialers are in working condition and provide indicators for operation. The treatment sequence is automated batch mode with pH indicators at the clarifier and the effluent tank. Flow metering is provided in the lift station discharge line. Sludge dewatering in the frame filter press is a batch process, which combines the biological and metals precipitation of sludge prior to dewatering in the plate and frame filter press.

6. Solids

The underflow solids from the lamella clarifier and settling tank in the package biological treatment unit are pumped to a sludge thickening tank where the solids are allowed to concentrate prior to being pumped to the plate and frame filter press for dewatering. Solids from the press drop into a pair of small roll offs. The sludge is characterized and transported off site for disposal.

7. Conditions

Housekeeping is excellent and overall the plant appears to be well operated. Operator convenience, materials of construction and plant hydraulics appear to be well thought out and detailed.

VIII. Issues

Several issues were discovered during the five-year review and are discussed in this section. None of these issues are sufficient to warrant a finding of "not protective" as long as corrective action is taken. There were no indications of early potential failure.

A. OU1 and OU2 Landfills

- Surface runoff from the OU2 landfill has caused localized erosion.
- Several large areas have stressed or denuded vegetation due to dry conditions.
- Several gas control vents are leaning/tilted. A gas vent tilting down slope may be an indication of cover soil movement.
- Operator indicated that gas readings are not taken and recorded on either OU1 or OU2 landfills.
- Several areas of the perimeter fence are damaged due to fallen trees. Vandals have been able to breach security fence at several places and access the site through culverts.

B. Leachate Collection, Extraction and Transmission

- Influent samples for each operable unit should be taken and analyzed quarterly until a trend can be established. The need for treatment may diminish over time and eventually meet discharge standards with less aggressive treatment.

C. Groundwater Migration Monitoring

• The monitoring data were inconclusive regarding containment of the leachate. The three rounds of data reviewed varied significantly, and were inconclusive regarding migration prevention when compared with background concentrations. The contaminant concentrations need to be reevaluated annually and plotted on a site map as part of the annual report to determine if the leachate capture system is successfully preventing migration off site.

• The ROD requires deed restrictions be implemented to eliminate the possibility of domestic water wells being installed within the fenced-in are of the Site. There was no evidence during the five-year review that deed restrictions have been implenented.

• A local quarry is located nearby. Blasting is a common occurrence, and has been suspected of altering the groundwater flow conditions in the fractured bedrock. Monitoring of the remedy to ascertain the impact of off-site blasting operations to groundwater flow should be continued.

D. Leachate Treatment

• Cleaning Frequency. The metals removal unit was responsible for exceeding discharge criteria due to an excess buildup of material on the tank sidewalls. The tanks should be periodically inspected to eliminate future occurrences.

• GAC Testing. GAC should be monitored for breakthrough following the second unit for a period of time following detection of indicator compounds in the effluent from the lead unit. Lead column replacement is not immediately necessary following breakthrough of the lead column.

IX. Recommendations

The following recommendations are made to address the issues noted above:

A. Landfill

• Take corrective action to repair several areas of localized erosion on the OU2 cap.
• Take corrective action to repair/reestablish ground cover at several area locations experiencing stressed vegetation.
• Investigate reason for gas control vents that are leaning and take appropriate corrective action.
• Take quarterly readings and monitor gas vents on OU1 and OU2 landfills until several rounds of data show low or no readings.
• Repair and secure several portions of perimeter fence and culverts.

B. Leachate Collection, Extraction and Transmission.

• The monitoring data were inconclusive regarding containment of the leachate. The three rounds of data reviewed varied significantly, and were inconclusive regarding migration prevention when compared with background concentrations. Contaminant concentrations should be reevaluated annually and plotted on a site map as part of the annual report to determine whether or not the leachate capture system is preventing migration off site.

• Implement the ROD deed restrictions to eliminate the possibility of domestic water wells being installed within the fenced boundary of the Site.

• A local quarry is located nearby. Blasting is a common occurrence, and has been suspected of altering the groundwater flow conditions in the fractured bedrock. Evaluation of the impacts of blasting operations should be done to ascertain if these activities could compromise the remedy.

C. Leachate Treatment.

• The tanks of the metals removal unit should be periodically inspected to eliminate future occurrences of buildup of material on the tank sidewalls.

• GAC unit should be monitored for breakthrough following the second unit for a period of time following detection of indicator compounds in the effluent from the lead unit. Lead column replacement is not necessary immediately.

D. Fence.

• Repair the damaged fence at the perimeter and implement erosion control measures.

E. O&M Manual and Quarterly Inspection Report Form:

• Inspect gas vent pipes for damage or tilting. A gas vent well tilting down slope may be an indication of cover soil movement. Correct as appropriate.

• The Quarterly Inspection Report Form should provide some space for the inspector/operator to provide a narrative explanation of deficient items found during O&M inspections.

• A form should be added to the O&M manual to document non-routine maintenance such as washout of the access road, cover soil slides, etc.

• Requirements for reports distribution and frequency of generation should be indicated in the O&M Manual.

• Emergency numbers should also be included to alert agencies in case of a contaminant release. A list of contacts such as the design engineer and construction contractor is also typically included in an O&M Manual.

• The O&M Manual needs to address initial and ongoing operator O&M and OSHA training.

• For leachate treatment systems, the O&M manual should address testing, manifesting, transportation and disposal sites. The manual should contain a copy of the letter and other documentation from the landfill that specifies the conditions and profile of the wastes under which they will accept the filter cake.

• Address purchase and inventory of spare parts, materials, and supplies.

• Specify how the manual will be kept current.

X. Protectiveness Statement

Based on this Five-Year Review and the above summary, the following conclusions are drawn:

The remedy at the Site currently protects human health and the environment because it eliminates the exposure pathways relative to surface soils, surface water and leachate water in the short term.

The landfill cap is effective at containing contaminants through preventing infiltration of storm water and preventing direct contact or exposure of landfill waste by humans and fauna.

The leachate collection and transmission system prevents migration of hazardous substances offsite or to streams or groundwater.

The leachate treatment system is effective in meeting the discharge limits established by the USEPA and the State of Kentucky for the site contaminants.

However, in order for the remedy to be protective in the long term, the following actions should be taken:

1) Implement deed restrictions; and
2) Verify migration prevention to determine whether or not the leachate capture system is successfully preventing migration off site.

Statutory based reviews of the operation, maintenance, and functioning of the landfill cap, leachate collection and transmission system, leachate treatment system, and discharge/disposal system should continue until the USEPA makes a written determination that further reviews are unnecessary to ensure protectiveness.

XI. Next Review

The Smith's Farm Landfill Site is a statutory site that requires on-going five-year reviews. USEPA should conduct the next review within five years of completion of this first five-year review, listed as the date of signature on the inside cover of this report.

TABLES

Table 1: Chronology of Site Events, Smith's Farm Site

Event	Date
Landfill operations begin	1950s
Smith's Farm Landfill formally listed on NPL	June 1986
Landfill ceases waste operations	May 1989
Administrative Order on Consent (AOC) between EPA and PRP's to conduct RI/FS	November 9, 1989
State Notice of Violations to landowner for leachate problem	September 1991
Remedial Investigation (RI) and Feasibility Study (FS) completed	January 1992
ROD signed for Smith's Farm Landfill, OU-2	September 22, 1993
Unilateral Administrative Order (UAO) issued for ten PRP's to design and implement ROD remedy	April 22, 1994
Remedy Design Begins	June 1994
Remedy Construction Begins	March 1996
Remedy Construction Completed	September 1998

Table 2 Site Remedial History for OU1 and OU2

OU	Action Name	Actual Start	Actual Completion
00	DISCOVERY		02/01/1980
00	PRELIMINARY ASSESSMENT		07/01/1982
00	SITE INSPECTION		08/01/1984
00	REMOVAL	06/18/1984	08/17/1984
00	PROPOSAL TO NPL		10/15/1984
00	NPL RP SEARCH		05/15/1985
00	FINAL LISTING ON NPL		06/10/1986
00	RI/FS NEGOTIATIONS	03/15/1987	04/15/1987
00	REMOVAL	05/27/1988	05/27/1988
00	NPL RP SEARCH		01/31/1989
01	ADMINISTRATIVE RECORDS	06/01/1989	06/01/1989
01	COMBINED RI/FS	04/03/1987	09/29/1989
01	RECORD OF DECISION		09/29/1989
00	ADMINISTRATIVE RECORDS	12/29/1988	10/04/1989
01	ADMIN ORDER ON CONSENT		11/13/1989
01	RD/RA NEGOTIATIONS	12/20/1989	03/14/1990
01	UNILATERAL ADMIN ORDER		03/14/1990
00	REMOVAL ASSESSMENT	09/30/1991	09/30/1991
01	ROD Amendment		09/30/1991
01	PRP RD	05/04/1990	04/14/1992
02	PRP RI/FS	11/09/1989	09/17/1993
02	RECORD OF DECISION		09/17/1993
02	RD/RA NEGOTIATIONS	10/29/1993	04/22/1994
02	UNILATERAL ADMIN ORDER		04/22/1994
02	PRP RD	06/01/1994	03/13/1996
01	PRP RA	05/20/1993	04/22/1996
00	CONSENT DECREE	07/25/1997	10/10/1997
00	ADMIN ORDER ON CONSENT		01/23/1998
00	FIVE YEAR REMEDY ASSESSMENT	03/01/1998	09/30/1998

Table 3: Groundwater Monitoring Schedule

Group	Monitoring Period	Monitoring Frequency
A	Years I - 30	Annual
B	Years I - 5 Years 6 - 30	Semi-annual Annual
C	Years I - 30	Annual
D	NA	When a release is detected in a Group B well

Table 4: Treatment Plant Effluent Discharge Criteria

PARAMETER	LIMIT	PARAMETER	LIMIT
Benzene	<5 ug/l	Antimony	62 ug/l
Butyl benzyl phhialate	<10 ug/l	Arsenic	11 ug/l
2-Chlorophenol	<23 ug/l	Barium	231 ug/l
1,2-Dichlorobenzene	<5 ug/l	Beryllium	5.3 ug/l
1,4-Dichlorobenzene	<5 ug/l	Cadmium	1.1 ug/l
l,l-Dichloroethane	<5 ug/l	Chromium(VI)	11 ug/l
1,2-Dichloroethane	<5 ug/l	Copper	12 ug/l
1,2-Dichloroethene, total	<5 ug/l	Cyanide	5 ug/l
Dichloromethane	<5 ug/l	Iron	1.0 mg/l
1,2-Dichloropropane	<5 ug/l	Lead	3.2 ug/l
2,4 Dimethylphenol	<10 ug/l	Mercury	0.2 ug/l
Ethylbenzene	<5 ug/l	Nickel	0.160 mg/l
Nitrobenzene	250 ug/l	Selenium	0.005 mg/l
N-nitroso-di-n-propylamine	11 ug/l	Silver	0.5 ug/l
Phenol	<10 ug/l	Thallium	11 ug/l
Tetrachloroethene	<5 ug/l	Zinc	0.110 mg/l
Toluene	<5 ug/l		
1,2-Trichloroethane	<5 ug/l		
Trichloroethene	<5 ug/l		

Note: The discharge limits for the constituents of concern in Table 4 were established during design as the criteria required of the equipment manufacturers and the installation contractor. The effluent discharge criteria was established as 0.012 ug/l for Mercury and 0.12 ug/l for Silver. These detection levels are not currently achievable, therefore, the lowest possible reporting levels the laboratory 'can achieve (0.2 ug/l for Mercury and 0.5 mg/l for Silver) have been substituted.

Table 5 Annual O&M Costs

Dates		Total Cost rounded to nearest $100
From	To	
1/1996	12/1996	N/A (OU2 completed in Dec. 1998)
1/1997	12/1997	N/A (OU2 completed in Dec. 1998)
1/1998	12/1998	N/A (OU2 completed in Dec. 1998)
1/1999	12/1999	$411,697
1/2000	12/2000	$366,930

Table 6: Comparison of Initial and Current Leachate Concentrations

Constituent	1995 Basis for Design Concentration (mg/l)	2000 Average Concentration (mg/l)	Action Limit (mg/l)
Biological Oxygen Demand	2600	53	Report
Nickel	0.19	<0.05	0.16
Methylene Chloride	2.90	1.10	Report
Benzene	0.140	0.008	0.005
Phenol	29	0.29	0.10
TCE	0.38	0.012	0.005
Total Suspended Solids	160	32	Report

Table 7 Leachate Influent OU2

(All concentrations expressed in mg/l unless otherwise indicated)

		Sampling Date											
Analyte	**KPDES Stds**[1]	2/10/99	4/28/99	5/26/99	6/30/99	7/28/99	8/30/99	11/1/99	11/22/99	12/29/99	2/7/00	3/6/00	3/29/00
Biochemical Oxygen Demand (BOD_5)		110		52.3	37.8	34.4	55.1	49.9	58.3	76.9	79.6	55.6	25
Chemical Oxygen Demand (COD)		270	250	232	173	189	244	287	291	293	278	269	180
Ammonia Nirtogen (NH3)		20	16	6.8	14.7	12.9	7.83	14.9	6.74	12.6	7.85	5.23	
Nitrogen (Keldahl)		17	20	15.2	16	16	19	20	21	18.1	19	12	14
Nitrate (NO_3)													
Nitrite (NO_2)													
Nitrite + Nitrate (NO_2+NO_3)											0.25	0.27	0.15
Total Organic Carbon (TOC)		89	75	54.9	46.6	52.5	62.1	76	76	151	78	56.5	59
pH		7.9	6.9	6.77	7.03	6.8	6.88	6.79	7.02	7.47	7.83	7.63	7.31
Total Dissolved Solids (TDS)		1300	1400	1290	1390		1720	1740	1690	1670	1540	1490	1450
Total Suspended Solids (TSS)		31	10	36	20	29	36	28	107	19	16	16	14
Turbidity		200	160	154	153	155	110	186	196	38	30.5	38.2	67.5
Arsenic		0.0023	0.0021										
Barium	0.231	0.65	0.49	0.51	0.44	0.44	0.43	0.53	0.7	0.65	0.63	0.1	0.5
Calcium		160	150	134	132	143	156	156	139	138	135	53.3	127
Iron	1	20	15	15.7	17.8	14.9	10.7	14.7	22.3	8.63	4.15	0.1	7.58
Magnesium		97	94	89.9	84.6	98.1	102	101	88.9	96	93.2	84.7	98
Manganese		2.1	2	1.85	1.6	1.95	1.91	1.77	1.49	1.69	1.46	1.46	1.37
Nickel	0.16	0.021											
Selenium	0.005	0.0058	0.0035										
Zinc	0.11	0.0029											
Acetone		5100	7000	5000		3000	3800	2300	200	5300	4500	2700	

Table 7 Leachate Influent OU2 (con't)

(All concentrations expressed in micrograms/liter (µg/l) unless otherwise indicated)

		Sampling Date											
Analyte	**KPDES Stds**[1]	2/10/99	4/28/99	5/26/99	6/30/99	7/28/99	8/30/99	11/1/99	11/22/99	12/29/99	2/7/00	3/6/00	3/29/00
Chloroform		330		590	590	590	590	300	5	42	300	130	
2-Butanone				2300		1200	1600	1200	100	2700	2100	1700	
4-Methyl 2-Pentanone (MIBK)								410	10	880	500	480	
2 Hexanone								11	10	50	21	12	
Methylene Chloride	5	1100	2200	1700	1700	750	750	840	50	1400	1000	470	
Perchloroethylene (1,1,2,2PCE)	5		130					68	5	98	85	61	
Toluene	5		200					77	5	92	100	32	
Benzene	5							22	5		22	8	
Ethyl Benzene	5							20	5		45	31	
Xylene								280	5	260	350	150	
1,1,2 Trichloroethane (1,1,2 TCA)	5		310					160	5	67	190	120	
1,1,1 Trichloroethane (1,1,1 TCA)	5		130					52	5		46		
Trichloroethylene (TCE)	5							28	5	32	34	12	
Isophorone		93		53	33	32	42	60		11	69	54	
2,4-DiMethyl Phenol											13	13	
2-Methyl Phenol		76	110	59	41	34	43	58		71	64	44	
Phenol		470	990	360		200		54	31	490		330	
4-Methyl Phenol				64	42	29	49	66			65	44	
Naphthalene				110	110		110						
2-Methyl Naphthalene				26	26	26							
Hexachlorocyclo-pentadiene				28									
bis (2 Ethylhexyl) phthalate									10				
2,2 oxybis (1 Chloroproylamine)										71			

TABLE 8 40 CFR 445.10 Effluent Limitations

Regulated Parameter	Maximum Daily[1]	Maximum Monthly Avg.[1]
BOD_5	220	56
TSS	88	27
Ammonia (as N)	10	4.9
a- Terpineol	0.042	0.019
Aniline	0.024	0.05
Benzoic Acid	0.119	0.073
Naphthalene	0.059	0.022
r- Cresol	0.024	0.05
*Phenol	0.048	0.029
Pyridine	0.072	0.025
*Arsenic	1.1	0.54
*Chromium	1.1	0.46
*Zinc	0.535	0.296
pH	([2])	([2])

[1] Milligrams per liter (mg/l, ppm)
[2] Within the range 6 to 9
* Previously defined parameters (ROD, State correspondence)

TABLE 9 Sector L Industry Monitoring Requirements

Regulated Parameter	Maximum Daily[1]	Maximum Monthly Avg.[1]
BOD_5	140	37
TSS	88	27
Ammonia (as N)	10	4.9
α- Terpineol	0.033	0.016
Benzoic Acid	0.12	0.071
ρ- Cresol	0.025	0.014
*Phenol	0.026	0.015
*Zinc	0.20	0.11
pH	6 - 9	6 - 9

[1] Milligrams per liter (mg/l, ppm)
[2] Within the range 6 to 9
* Previously defined parameters (ROD, State correspondence)

TABLE 10 Effluent Parameters Summary

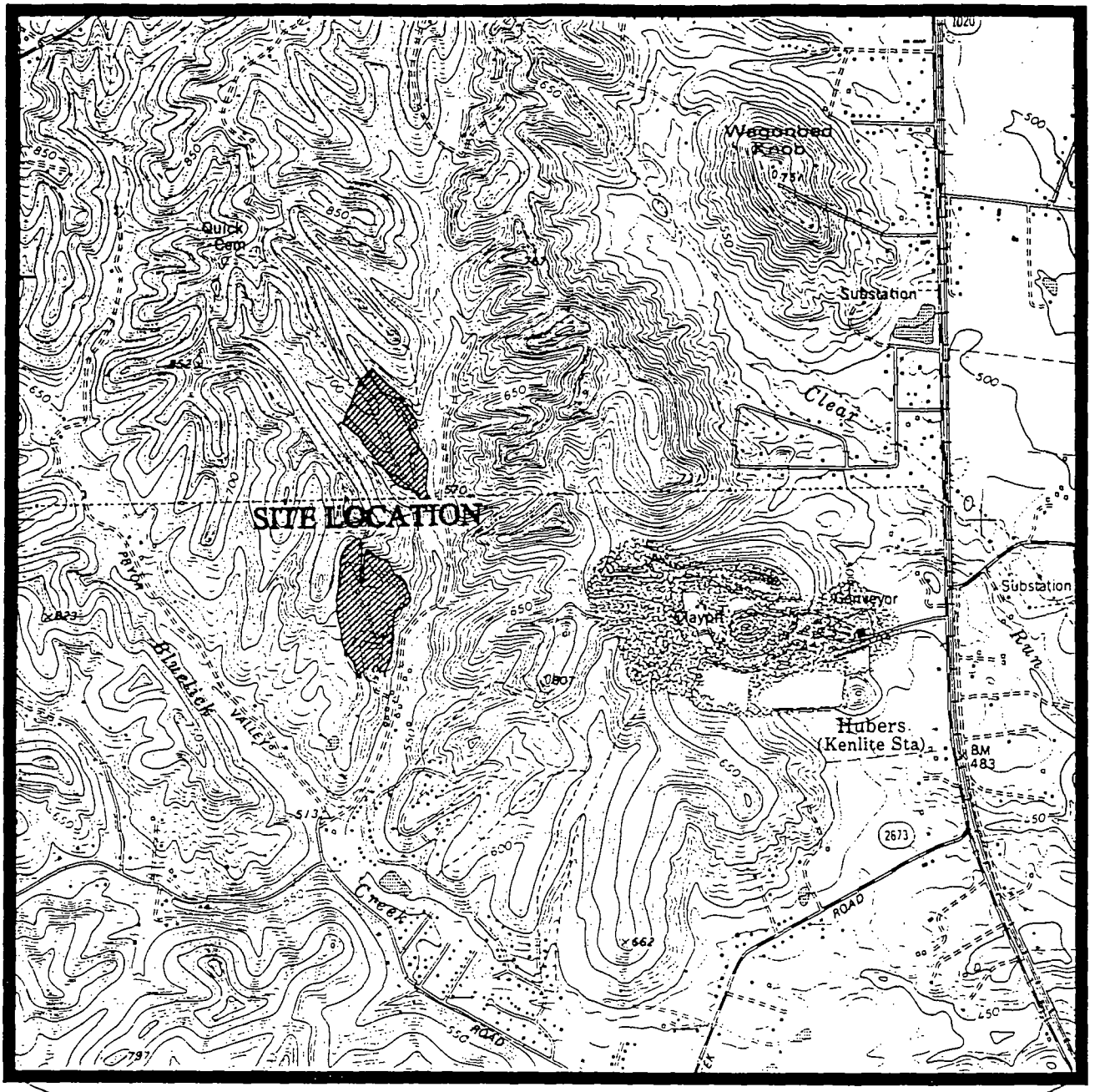
Effluent Parameters	KDEP letter* 7/10/1997	ROD 9/17/93	LAW O&M Manual Table 1.1 values March 1999
Antimony*	1.6 mg/l	**0.062 mg/l**	0.062 mg/l
Arsenic*	0.050 mg/l	**0.011 mg/l**	0.011 mg/l
Barium		**0.231 mg/l**	0.231 mg/l
Beryllium*	0.0053 mg/l		0.0053 mg/l
Cadmium*	0.0011 mg/l		0.0011 mg/l
Hexavalent Chromium	0.011 mg/l	**0.011 mg/l**	0.011 mg/l
Copper*	0.012 mg/l		0.012 mg/l
Free Cyanide	0.005 mg/l		0.005 mg/l
Iron*	1.0 mg/l		1.0 mg/l
Lead*	0.0032 mg/l		0.0032 mg/l
Mercury*	0.000011 mg/l		0.0002 mg/l**
Nickel*	0.160 mg/l		0.160 mg/l
Selenium*	0.005 mg/l		0.005 mg/l
Silver*	0.00012 mg/l		0.0005 mg/l**
Thallium*	0.040 mg/l	**0.011 mg/l**	0.011 mg/l
Zinc*	**0.110 mg/l**		0.110 mg/l
2-chlorophenol		**0.023 mg/l**	0.023 mg/l
Methylene Chloride	**< 0.005 mg/l**	5.870 mg/l	< 0.005 mg/l
Nitrobenzene		**0.250 mg/l**	0.250 mg/l
N-nitroso-di-n-propylamine		**0.011 mg/l**	0.011 mg/l
1,1-Dichloroethane	**< 0.005 mg/l**		< 0.005 mg/l
1,1-Dichloroethene, total	**< 0.005 mg/l**		< 0.005 mg/l
1,2-Dichloroethane	**< 0.005 mg/l**		< 0.005 mg/l
1,2-Dichloropropane	**< 0.005 mg/l**		< 0.005 mg/l
Trichloroethene	**< 0.005 mg/l**		< 0.005 mg/l
Benzene	**< 0.005 mg/l**		< 0.005 mg/l
1,1,2-Trichloroethane	**< 0.005 mg/l**		< 0.005 mg/l
Tetrachloroethene	**< 0.005 mg/l**		< 0.005 mg/l
Toluene	**< 0.005 mg/l**		< 0.005 mg/l
Ethylbenzene	**< 0.005 mg/l**		< 0.005 mg/l
1,2-Dichlorobenzene	**< 0.005 mg/l**		< 0.005 mg/l
1,4-Dichlorobenzene	**< 0.005 mg/l**		< 0.005 mg/l
Phenol	**< 0.005 mg/l**	365 mg/l	*< 0.010 mg/l*
2,4-Dimethylphenol	**< 0.005 mg/l**	4.570 mg/l	*< 0.010 mg/l*
Butyl benzyl phthalate	**< 0.005 mg/l**		< 0.010 mg/l

*Note: Parameters listed in the above table with an (*) were indicated in the 7/10/97 letter from Kentucky Department of Environmental Protection to Law Environmental as "Total Recovery."

**Note: Law Environmental O&M Manual (March 1999) stated the discharge limits for mercury and silver were established during design, as criteria required of the equipment manufacturers and the installation contractor. The effluent discharge criteria were established as 0.000012 mg/l Mercury and 0.00012 mg/l for Silver. These detection levels are not currently achievable, therefore, the lowest possible reporting levels the laboratory can achieve (0.0002 mg/l Mercury and 0.0005 mg/l Silver) have been established.

SOURCE: U.S. GEOLOGICAL SURVEY; 7.5 MINUTE SERIES (TOPOGRAPHIC)
BROOKS, KENTUCKY QUADRANGLE; DATED 1981, REVISED 1994

N

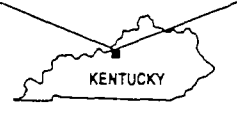


0 0.5 1

APPROXIMATE SCALE IN MILES

0 1000 2000 3000 4000 5000

APPROXIMATE SCALE IN FEET



QUADRANGLE LOCATION

SMITH'S FARM
BULLITT COUNTY, KENTUCKY

PROJECT NO. 12000-8-0206

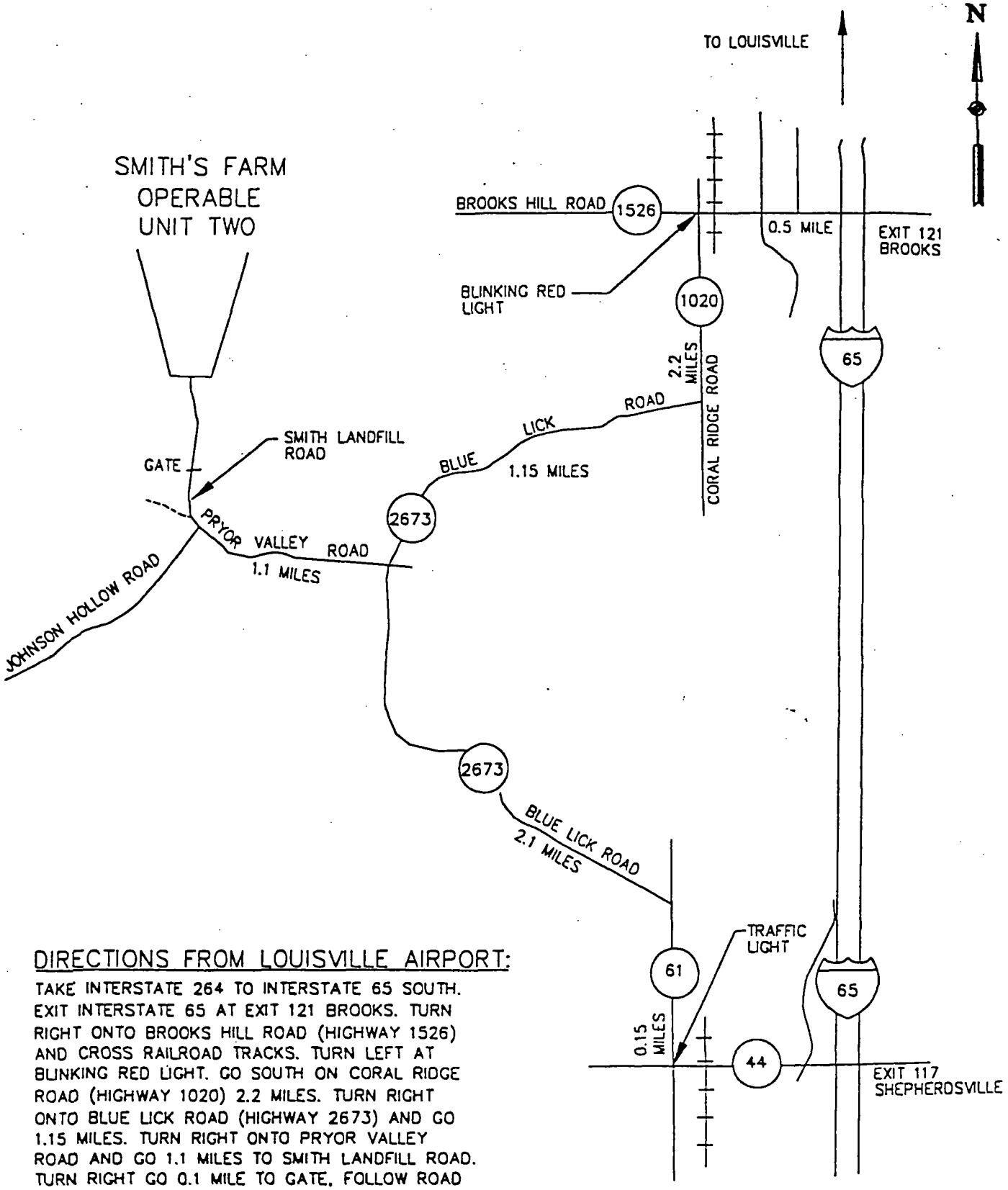
LAW
ENGINEERING AND ENVIRONMENTAL SERVICES, INC.
9810 BLUEGRASS PARKWAY
LOUISVILLE, KENTUCKY 40299
(502) 495-5800
FAX (502) 495-5801

SITE LOCATION MAP

CADD FILE: 000206_3
PLOT DATE: 02/24/00

FIGURE 1

FILE: SMITH02/MC-MAP DATE: 3/9/99



DIRECTIONS FROM LOUISVILLE AIRPORT:

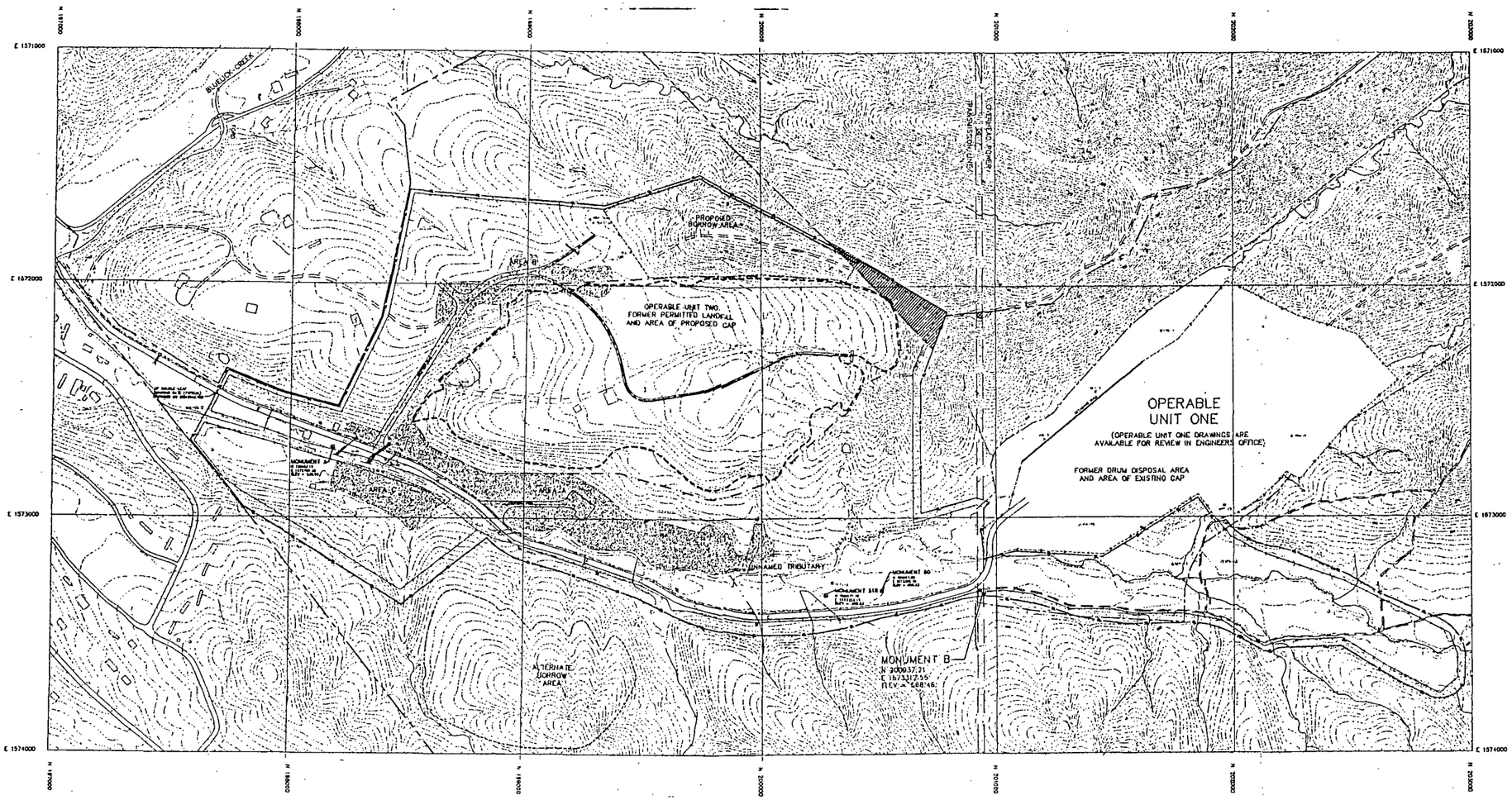
TAKE INTERSTATE 264 TO INTERSTATE 65 SOUTH. EXIT INTERSTATE 65 AT EXIT 121 BROOKS. TURN RIGHT ONTO BROOKS HILL ROAD (HIGHWAY 1526) AND CROSS RAILROAD TRACKS. TURN LEFT AT BLINKING RED LIGHT. GO SOUTH ON CORAL RIDGE ROAD (HIGHWAY 1020) 2.2 MILES. TURN RIGHT ONTO BLUE LICK ROAD (HIGHWAY 2673) AND GO 1.15 MILES. TURN RIGHT ONTO PRYOR VALLEY ROAD AND GO 1.1 MILES TO SMITH LANDFILL ROAD. TURN RIGHT GO 0.1 MILE TO GATE. FOLLOW ROAD TO SITE.

FIGURE 1.1

SITE LOCATION MAP

PREPARED FOR

SMITH'S FARM OPERABLE UNIT TWO



SMITH'S FARM MONITORING WELLS		
WELL LOCATION	NORTHING	EASTING
OU1		
* MW-1	203217.19	1571299.84
MW-2	202625.09	1571448.68
MW-3	201985.97	1571937.62
MW-4	201697.45	1572188.20
MW-5	201422.70	1572454.16
MW-6	201203.80	1572682.10
MW-7	201003.00	1572914.52
** MW-8	SURVEYED LOCATION NOT AVAILABLE	
* MW-9	203526.66	1571869.33
* MW-10	203070.12	1572114.87
MW-11	202246.70	1572653.25
** MW-12	NOT FOUND 9/11/95	
MW-13	201851.22	1573191.44
MW-14	201741.16	1573198.95
MW-15	201350.83	1573034.00
OU2		
MW-1	189388.07	1571879.50
MW-2	198050.25	1572635.68
** MW-3	NOT FOUND 6/26/95	
MW-4	199492.04	1573030.07
** MW-5	NOT FOUND 6/26/95	
MW-6	199398.84	1571878.70
** MW-7	NOT FOUND 6/26/95	
MW-8	198727.10	1572432.61
MW-16	200299.07	1573270.13
MW-17	199879.01	1573022.28
MW-18	198437.36	1572773.63
MW-19	197625.54	1572538.35
MW-20	197014.20	1571989.87
MW-21A	204045.14	1573222.98
MW-21B	204006.38	1573212.63
MW-21C	204026.45	1573221.96
MW-22A	199557.57	1573012.93
MW-22B	199518.03	1573010.58
MW-23A	198298.49	1572723.91
MW-23B	198270.41	1572720.03
MW-24A	199272.22	1571738.81
MW-24B	199260.28	1571723.01

* NOT SHOWN ON DRAWING
** SHOWN ON DRAWING BUT NOT FIELD LOCATED

LEGEND:

- PROPERTY LINE
- APPROXIMATE LIMITS OF WASTE
- EXISTING UNPAVED ROADS
- EXISTING PAVED ACCESS ROAD
- EXISTING CONTOUR
- EXISTING DITCH
- PROPOSED PERMANENT FENCE
- EXISTING FENCE
- PROPOSED PERMANENT EASEMENT OR PROPERTY AQUISITION
- AREA OF SPECIAL INTEREST
- CONSTRUCTION LIMITS
- EXISTING MONITORING WELL

NOTES:

1. THIS DRAWING DEPICTS THE CONSTRUCTION AREA IN ITS ENTIRETY AND ESTABLISHES THE CONSTRUCTION LIMITS. DETAILED INFORMATION FOR THE CONSTRUCTION AREA IS DEPICTED IN SUBSEQUENT DRAWINGS.
2. SEE DRAWING GR-005 FOR EXPLANATION OF AREAS OF SPECIAL INTEREST.
3. CONTRACTOR SHALL USE CAUTION WHEN WORKING IN THE VICINITY OF OVERHEAD POWER LINES AND SHALL OBSERVE SAFE WORK PRACTICES.
4. IN AREAS WHERE THE PROPERTY LINE IS WITHIN APPROXIMATELY 10 FEET OF THE CONSTRUCTION LIMITS OR WHERE THE PROPERTY LINE IS INSIDE THE CONSTRUCTION LIMITS, CONTRACTOR SHALL ESTABLISH THE PROPERTY LINE LOCATION.

SCALE IN FEET
0 200 400

REV	DATE	BY	SUB/APP	DESCRIPTION

DESIGNED
DRAWN
CHECKED
IN CHARGE
DATE 6 NOV 95

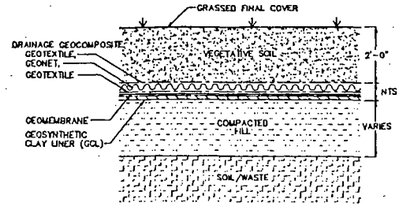
SMITH'S FARM OPERABLE UNIT TWO
BULLITT COUNTY, KENTUCKY

SUBMITTED
LAW ENGINEERING AND ENVIRONMENTAL SERVICES
APPROVED

Figure 2
Site Plan, OU2, OU1

SCALE: AS SHOWN
CONTRACT: 41-963508
DWG. NO. GR-004 | REV/PAGE NO. 0 | 4

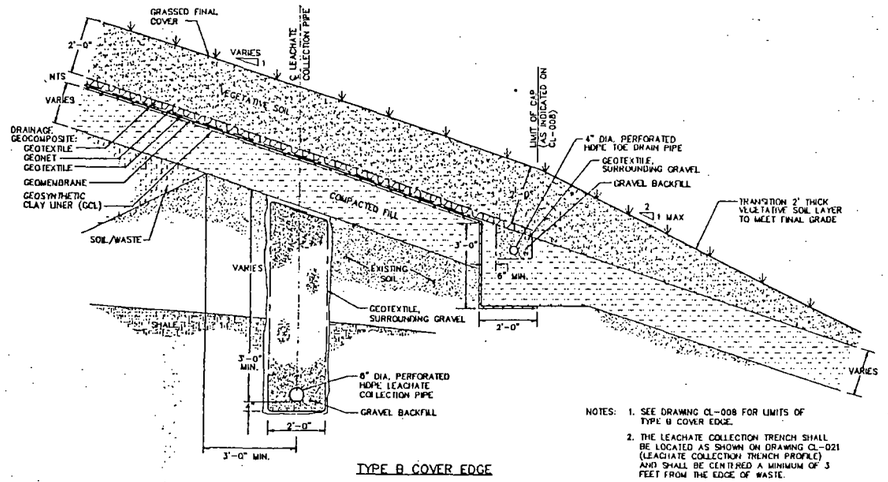
PLOT DATE 10/31/95



NOTES:
1. IN AREAS WHERE WASTE HAS BEEN CONSOLIDATED UNDER THE COVER, THE COMPACTED FILL LAYER SHALL HAVE A MINIMUM THICKNESS OF 3 FEET. IN ALL OTHER AREAS, THE COMPACTED FILL LAYER SHALL HAVE A MINIMUM THICKNESS OF 1 FOOT.
2. COMPACTED FILL SHALL MEAN SELECT SOIL FILL AND COMMON SOIL FILL AS DEFINED IN THE SPECIFICATIONS.
3. SOIL/WASTE SHALL MEAN EXISTING SOIL AND WASTE AS WELL AS SPECIAL FILL AND RESTRICTED SOIL FILL AS DEFINED IN THE SPECIFICATIONS.

TYPICAL SECTION THROUGH COVER

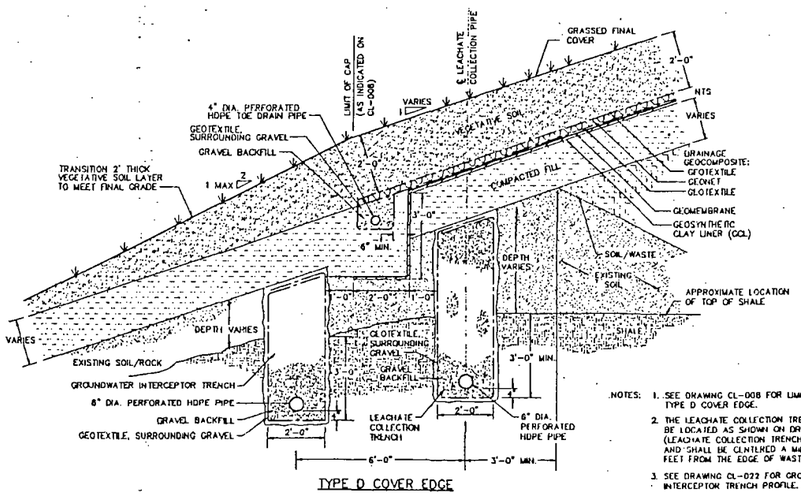
DETAIL 1.1 (CL-101) CL-008
SCALE: 1/2"=1'-0"



NOTES:
1. SEE DRAWING CL-008 FOR LIMITS OF TYPE B COVER EDGE.
2. THE LEACHATE COLLECTION TRENCH SHALL BE LOCATED AS SHOWN ON DRAWING CL-021 (LEACHATE COLLECTION TRENCH PROFILE) AND SHALL BE CENTERED A MINIMUM OF 3 FEET FROM THE EDGE OF WASTE.

TYPE B COVER EDGE

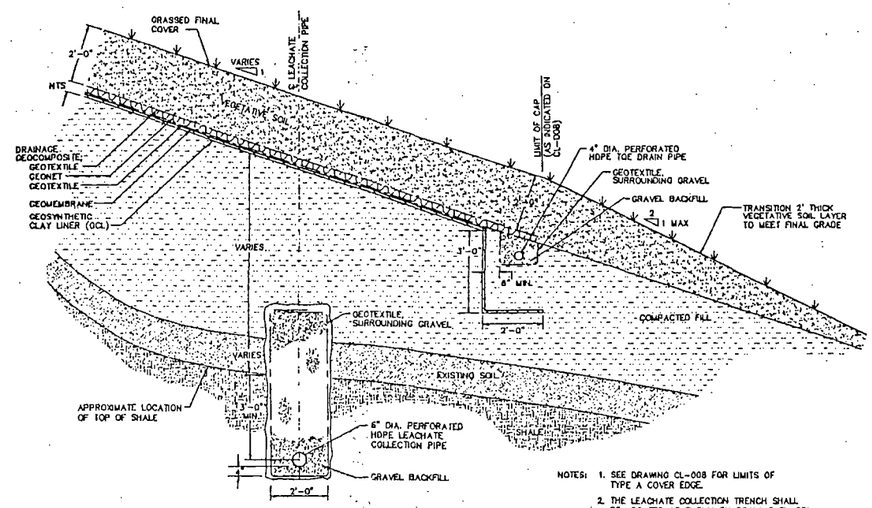
SECTION B (CL-101) CL-008
SCALE: 1/2"=1'-0"



NOTES:
1. SEE DRAWING CL-008 FOR LIMITS OF TYPE D COVER EDGE.
2. THE LEACHATE COLLECTION TRENCH SHALL BE LOCATED AS SHOWN ON DRAWING CL-021 (LEACHATE COLLECTION TRENCH PROFILE) AND SHALL BE CENTERED A MINIMUM OF 3 FEET FROM THE EDGE OF WASTE.
3. SEE DRAWING CL-022 FOR GROUNDWATER INTERCEPTOR TRENCH PROFILE.

TYPE D COVER EDGE

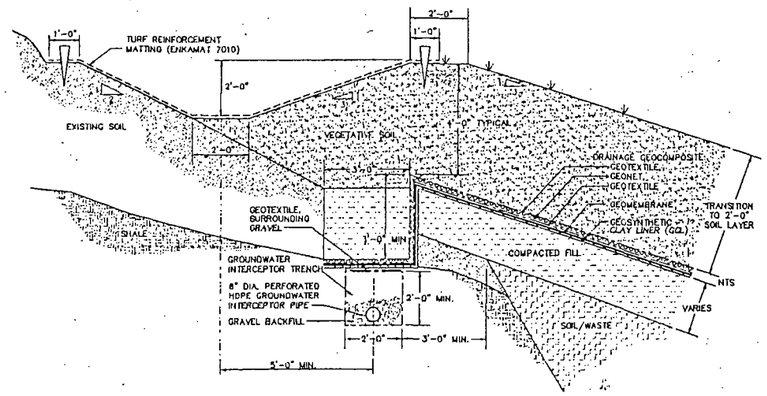
SECTION D (CL-101) CL-008
SCALE: 1/2"=1'-0"



NOTES:
1. SEE DRAWING CL-008 FOR LIMITS OF TYPE A COVER EDGE.
2. THE LEACHATE COLLECTION TRENCH SHALL BE LOCATED AS SHOWN ON DRAWING CL-021 (LEACHATE COLLECTION TRENCH PROFILE) AND SHALL BE CENTERED A MINIMUM OF 3 FEET FROM THE EDGE OF WASTE.

TYPE A COVER EDGE

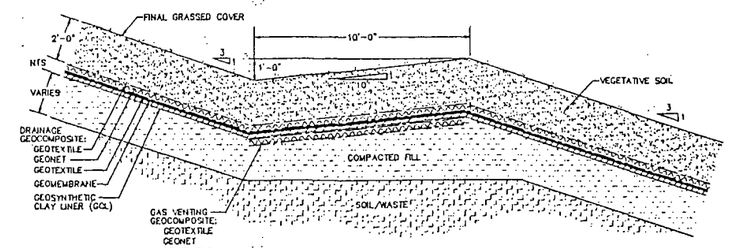
SECTION A (CL-101) CL-008
SCALE: 1/2"=1'-0"



NOTES:
1. SEE DRAWING CL-008 FOR LIMITS OF TYPE C COVER EDGE.
2. SEE DRAWING CL-022 FOR GROUNDWATER INTERCEPTOR TRENCH PROFILE.

TYPE C COVER EDGE

SECTION C (CL-101) CL-008
SCALE: 1/2"=1'-0"



NOTE: THE GAS VENTING GEOCOMPOSITE WILL NOT BE USED ON TERRACES OUTSIDE THE LIMITS OF THE CAP. SEE CL-010, GAS CONTROL PLAN.

TYPICAL FINAL COVER TERRACE

SECTION E (CL-101) CL-009
SCALE: 3/8"=1'-0"

REV	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED
DRAWN
CHECKED
IN CHARGE
DATE 6 NOV 95

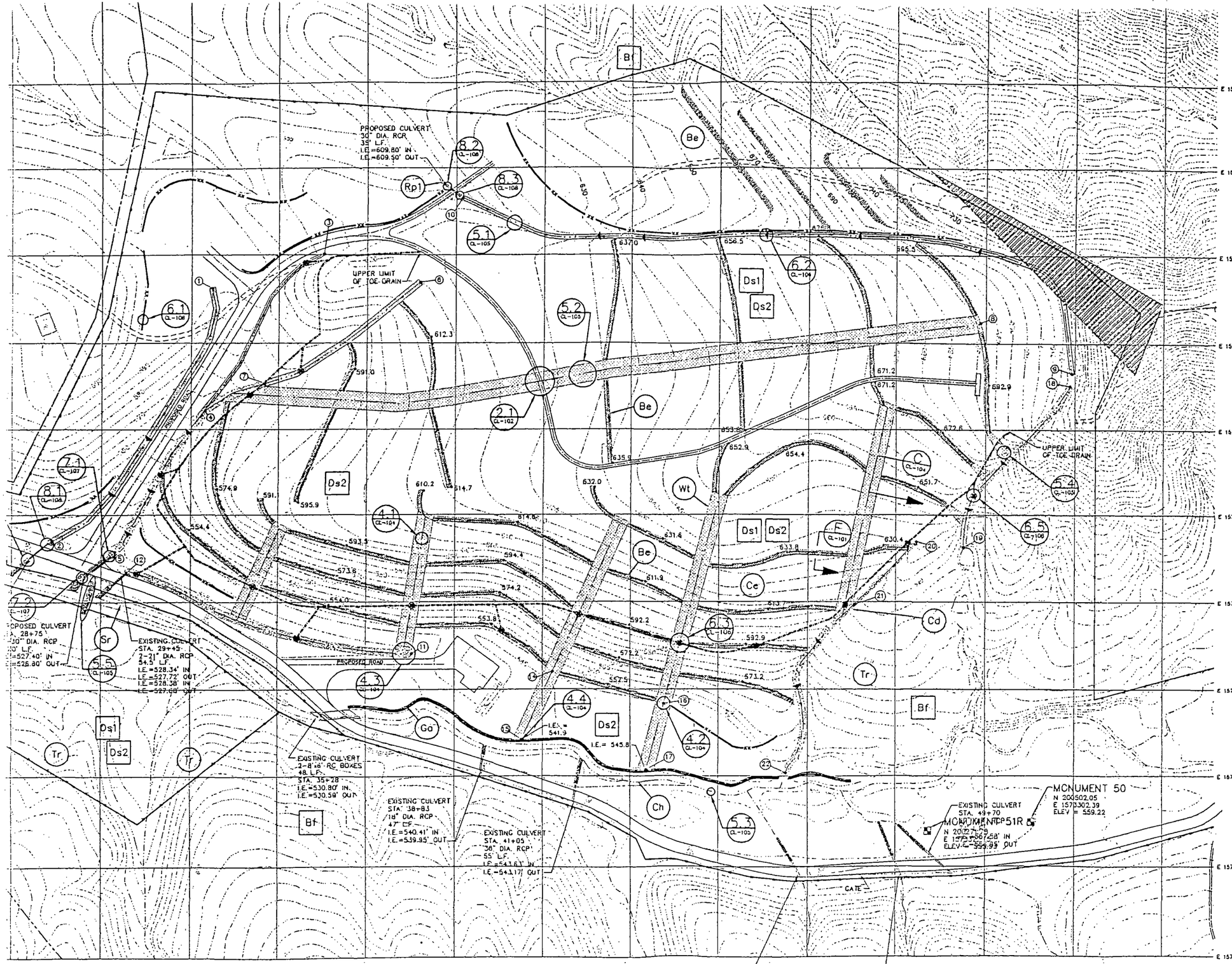
SMITH'S FARM OPERABLE UNIT TWO
BULLITT COUNTY, KENTUCKY

SUBMITTED

LAW ENGINEERING AND ENVIRONMENTAL SERVICES
APPROVED

Figure 2.1
Typical Cover Sections

SCALE: AS SHOWN
CONTRACT: 41-963508
DWG. NO.: CL-101 | REV: 0 | PAGE NO: 34



NOTES:

1. SEE DRAWING NO. CS-101 FOR EROSION CONTROL SYMBOLS.
2. SEE DRAWING NO. CR-005 FOR APPROXIMATE LOCATION OF WATER LINE. WATER LINE, LOCATED WEST OF THE PAVED ACCESS ROAD, IS NOT SHOWN HERE FOR CLARITY.
3. ELEVATION OF SUBGRADE SHALL VARY ALONG TERRACES TO MAINTAIN A UNIFORM THICKNESS OF SOIL COVER AS THE TERRACE ELEVATION VARIES FOR DRAINAGE.
4. DRAINAGE DITCH DIMENSIONS CANNOT BE ACCURATELY REPRESENTED AT THE SCALE OF 1"=100' ON THIS DRAWING. REFER TO DETAIL 5.1 ON DRAWING NO. CL-105 FOR DITCH DIMENSIONS.
5. HAY BALE SEDIMENT BARRIERS SHALL BE USED IN AREAS OF LOCALIZED EROSION OR AS DIRECTED BY THE ENGINEER. HAY BALE LOCATIONS ARE NOT SHOWN ON THIS DRAWING. REFER TO DETAIL 6.6 ON DRAWING NO. CL-106 FOR HAY BALE INFORMATION.
6. SEE DRAWING NO. CL-108 FOR TURF REINFORCEMENT MATTING (TRM) INSTALLATION DETAILS.

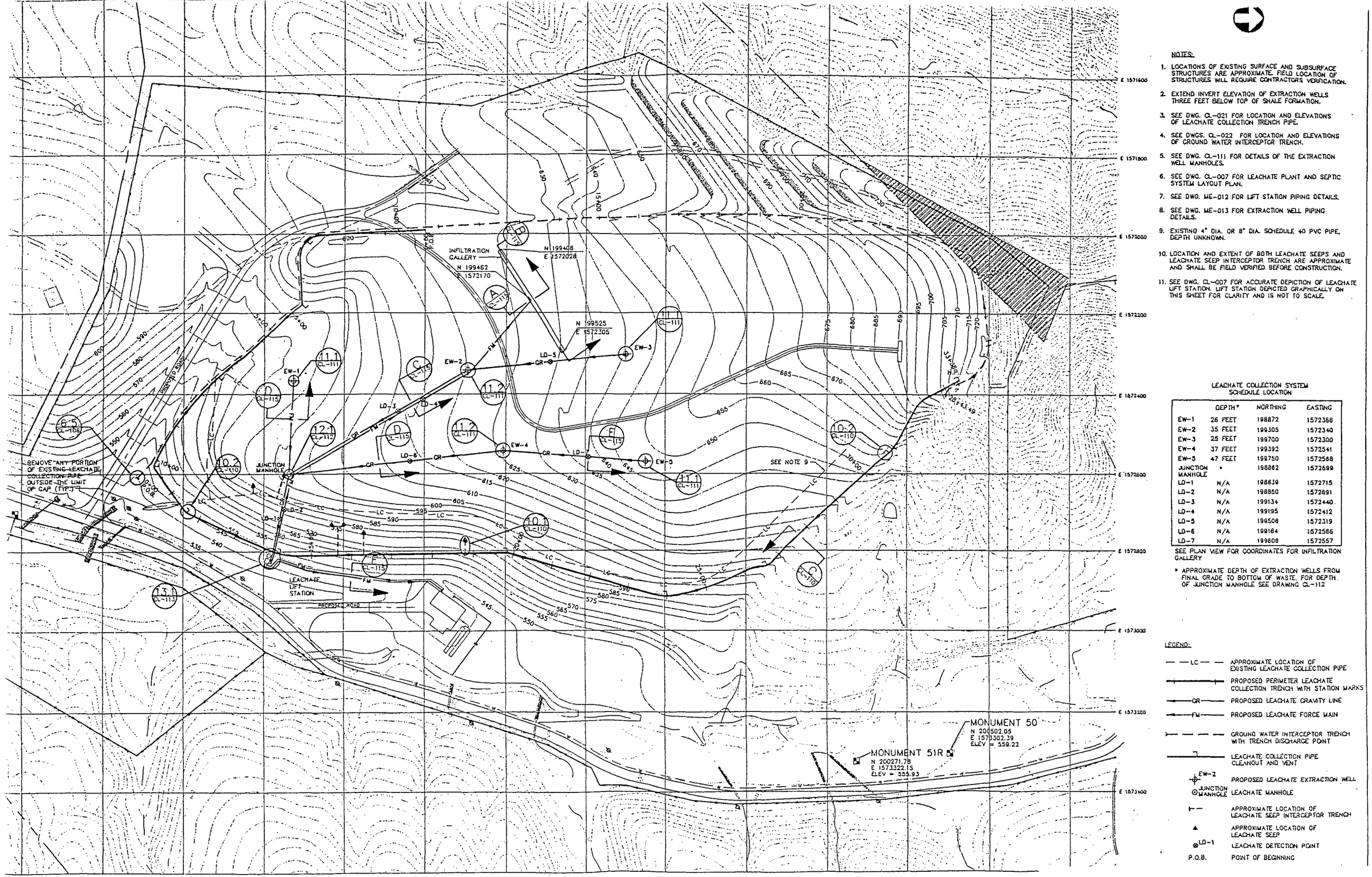
DRAINAGE DITCH SCHEDULE

DRAINAGE POINT	NORTHING	EASTING
1	198847.3	1572075.7
2	198289.6	1572860.4
3	198803.7	1571997.8
4	198631.1	1572355.3
5	198430.6	1572684.4
6	199118.9	1572061.5
7	198766.5	1572291.8
8	200837.0	1572151.7
9	200592.8	1572266.7
10	199213.1	1571869.9
11	199103.4	1572916.4
12	198456.1	1572732.2
14	199421.9	1572958.5
15	199350.9	1573116.6
16	199675.7	1573032.7
17	199835.0	1573185.4
18	200587.7	1572296.0
19	200350.3	1572674.7
20	200245.3	1572661.8
21	200105.1	1572805.4
22	199849.9	1573191.9

LEGEND:

- TOE DRAIN
- PROPERTY LINE
- GABIONS
- EXISTING DITCH
- PROPOSED PERMANENT FENCE
- TERRACE
- PROPOSED SILT FENCE
- PROPOSED CHECK DAM
- EROSION CONTROL REVEGETATION MATTING (ECRM)
- TRM (ENKAMAT 7020)
- TRM (ENKAMAT 7010)
- SOD
- PROPOSED DITCH
- SURFACE WATER FLOW DIRECTION
- 573.0 HIGH POINT ON TERRACE
- CULVERT WITH RIPRAP
- TOE DRAIN OUTLET

Figure 3
Surface Water Drainage/Erosion Contr



NOTES:

1. LOCATIONS OF EXISTING SURFACE AND SUBSURFACE STRUCTURES ARE APPROXIMATE. FIELD LOCATION OF STRUCTURES WILL REQUIRE CONTRACTORS VERIFICATION.
2. EXTEND INVERT ELEVATION OF EXTRACTION WELLS THREE FEET BELOW TOP OF SHALE FORMATION.
3. SEE DWG. CL-021 FOR LOCATION AND ELEVATIONS OF LEACHATE COLLECTION TRENCH PIPE.
4. SEE DWGS. CL-022 FOR LOCATION AND ELEVATIONS OF GROUND WATER INTERCEPTOR TRENCH.
5. SEE DWG. CL-111 FOR DETAILS OF THE EXTRACTION WELL MANHOLES.
6. SEE DWG. CL-007 FOR LEACHATE PLANT AND SEPTIC SYSTEM LAYOUT PLAN.
7. SEE DWG. ME-012 FOR LIFT STATION PIPING DETAILS.
8. SEE DWG. ME-013 FOR EXTRACTION WELL PIPING DETAILS.
9. EXISTING 4" DIA. OR 8" DIA. SCHEDULE 40 PVC PIPE, DEPTH UNKNOWN.
10. LOCATION AND EXTENT OF BOTH LEACHATE SEEPS AND LEACHATE SEEP INTERCEPTOR TRENCH ARE APPROXIMATE AND SHALL BE FIELD VERIFIED BEFORE CONSTRUCTION.
11. SEE DWG. CL-007 FOR ACCURATE DEPICTION OF LEACHATE LIFT STATION. LIFT STATION DEPICTED GRAPHICALLY ON THIS SHEET FOR CLARITY AND IS NOT TO SCALE.

LEACHATE COLLECTION SYSTEM SCHEDULE LOCATION

	DEPTH*	NORTHING	EASTING
EW-1	26 FEET	198872	1572366
EW-2	35 FEET	199305	1572340
EW-3	25 FEET	199700	1572300
EW-4	37 FEET	199392	1572541
EW-5	47 FEET	199750	1572568
JUNCTION MANHOLE	•	198862	1572599
LD-1	N/A	198839	1572715
LD-2	N/A	198850	1572691
LD-3	N/A	199134	1572440
LD-4	N/A	199195	1572412
LD-5	N/A	199508	1572319
LD-6	N/A	199164	1572586
LD-7	N/A	199608	1572557

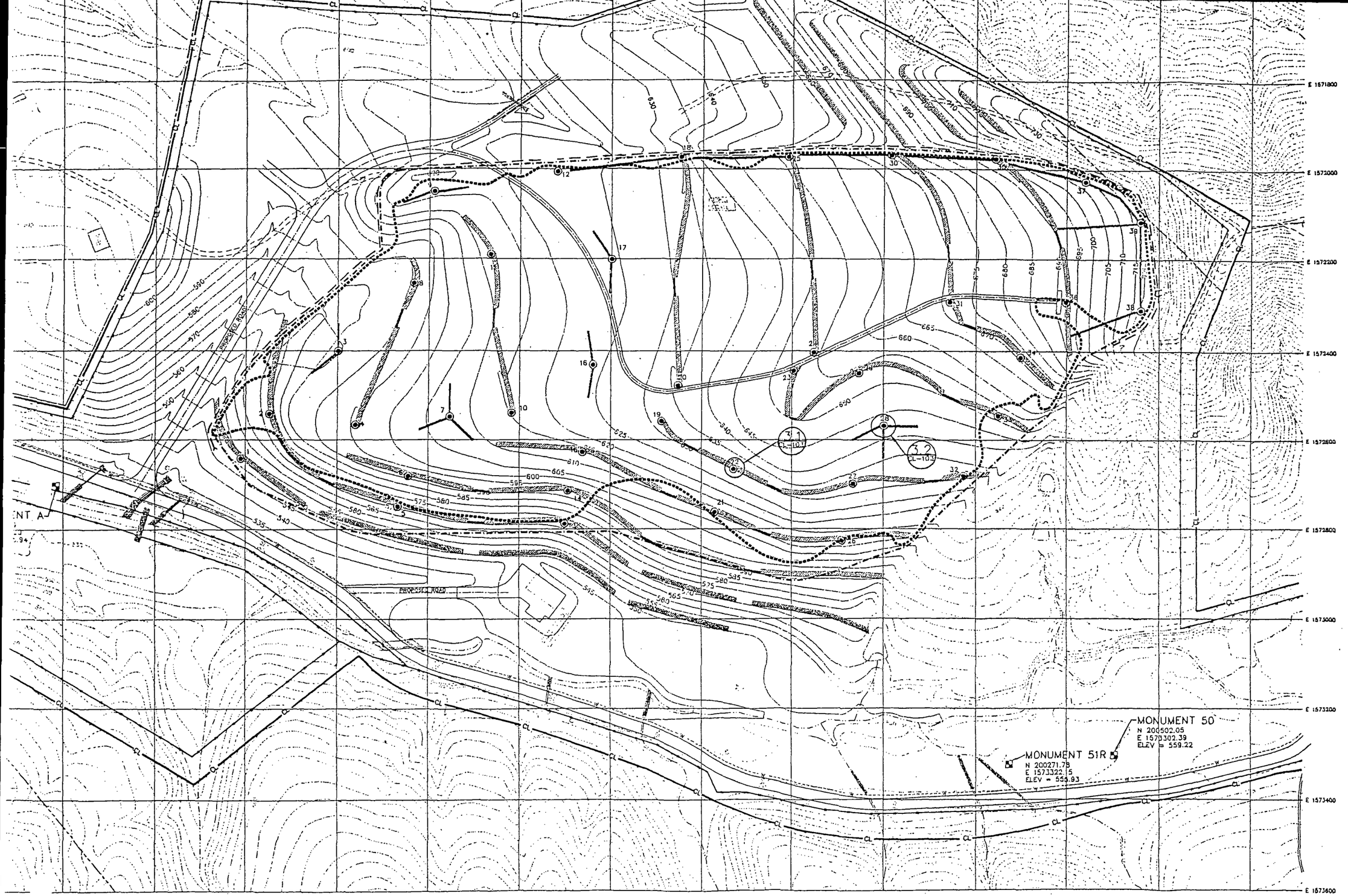
SEE PLAN VIEW FOR COORDINATES FOR INFILTRATION GALLERY

* APPROXIMATE DEPTH OF EXTRACTION WELLS FROM FINAL GRADE TO BOTTOM OF WASTE. FOR DEPTH OF JUNCTION MANHOLE SEE DRAWING CL-112

LEGEND:

- LC — APPROXIMATE LOCATION OF EXISTING LEACHATE COLLECTION PIPE
- PROPOSED PERIMETER LEACHATE COLLECTION TRENCH WITH STATION MARKS
- GR — PROPOSED LEACHATE GRAVITY LINE
- FM — PROPOSED LEACHATE FORCE MAIN
- GROUND WATER INTERCEPTOR TRENCH WITH TRENCH DISCHARGE POINT
- LEACHATE COLLECTION PIPE CLEANOUT AND VENT
- EW-2 PROPOSED LEACHATE EXTRACTION WELL
- JUNCTION MANHOLE LEACHATE MANHOLE
- APPROXIMATE LOCATION OF LEACHATE SEEP INTERCEPTOR TRENCH
- APPROXIMATE LOCATION OF LEACHATE SEEP
- LD-1 LEACHATE DETECTION POINT
- P.O.B. POINT OF BEGINNING

Figure 4
Leachate Collection System, OU2



GAS VENT SCHEDULE

VENT NUMBER	NORTHING	EASTING
1	198588.7	1572641.6
2	198650.2	1572539.7
3	198800.0	1572400.0
4	198837.1	1572564.6
5	198932.3	1572748.9
6	198954.2	1572680.4
7	199047.0	1572546.5
8	198965.1	1672252.4
9	199010.0	1572050.0
10	199181.9	1572537.9
11	199134.7	1572189.4
12	199279.3	1572004.9
13	199298.4	1572787.5
14	199305.9	1572714.1
15	199338.0	1572626.9
16	199380.0	1572430.0
17	199400.0	1572200.0
18	199551.9	1571973.1
19	199511.3	1572557.4
20	199546.9	1572476.1
21	199628.8	1572761.7
22	199669.8	1572664.6
23	199803.1	1572443.7
24	199846.9	1572402.6
25	199789.5	1571971.8
26	199908.8	1572825.5
27	199933.9	1572699.1
28	200000.0	1572567.5
29	199946.9	1572448.1
30	200014.5	1571968.8
31	200142.0	1572293.6
32	200172.0	1572680.9
33	200247.1	1572544.6
34	200296.6	1572413.1
35	200240.4	1571976.8
36	200386.7	1572293.3
37	200440.0	1572025.0
38	200560.0	1572310.0
39	200560.0	1572115.0

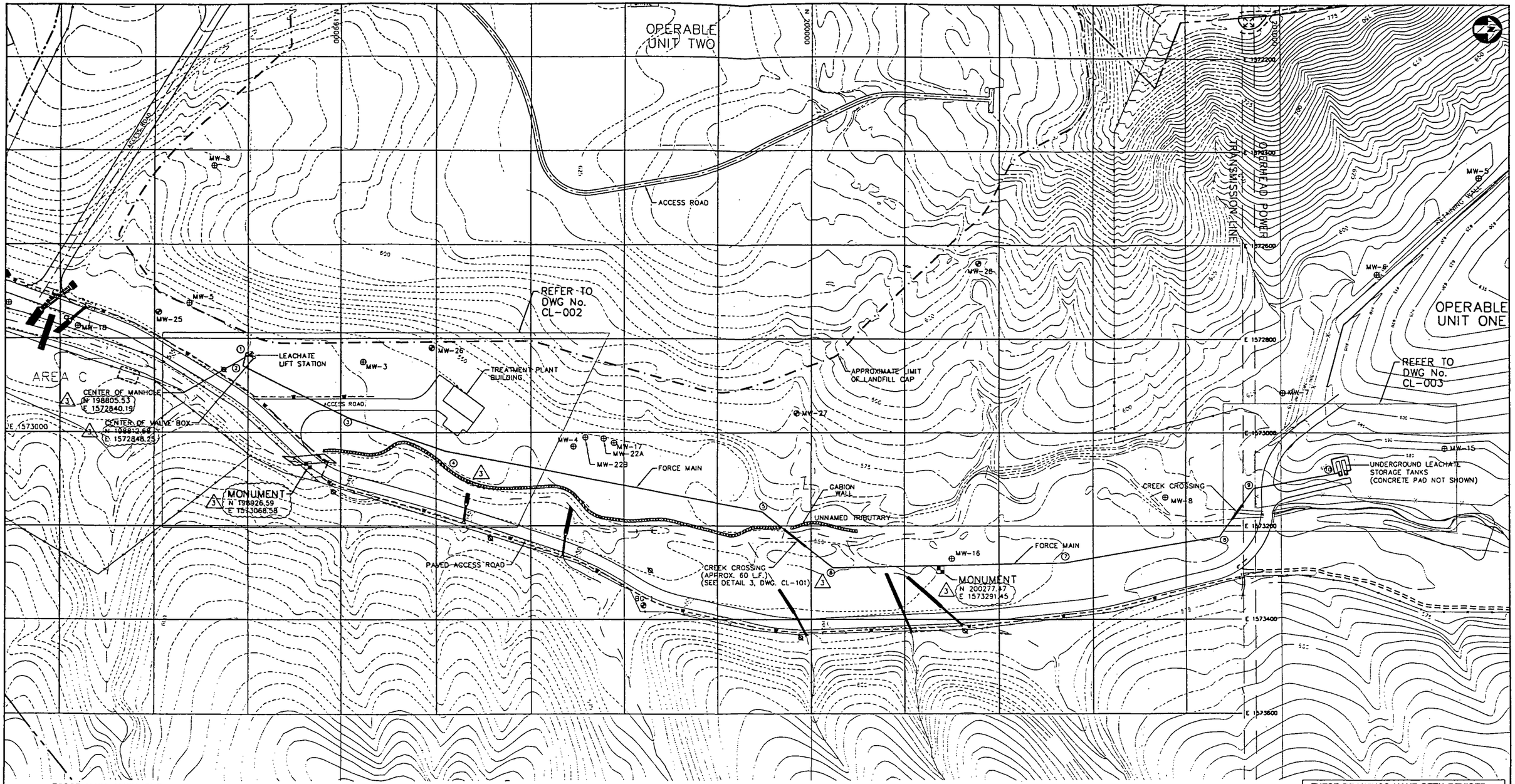
NOTE:

1. GAS VENTS TO BE CONSTRUCTED ON TERRACES SHALL BE CONSTRUCTED ON THE FRONT EDGE OF THE TERRACE.
2. GAS VENTS LOCATED ADJACENT TO WESTERN EDGE OF LANDFILLS SHALL BE LOCATED A MINIMUM OF SIX FEET FROM THE VERTICAL FACE OF THE TRENCH.

LEGEND:

- ⊙1 — PROPOSED GAS VENT AND DESIGNATION
- GAS VENTING GEOCOMPOSITE
- TERRACE WITH GAS VENTING GEOCOMPOSITE
- TERRACE WITHOUT GAS VENTING GEOCOMPOSITE

Figure 5
Gas Control System



FORCE MAIN ALIGNMENT

POINT No.	NORTH	EAST
1	198796	1572829
2	198789	1572857
3	199020	1572969
4	199215.8	1573040.5
5	199895	1573170
6	200047.8	1573290.9
7	200539	1573279
8	200871	1573223
9	200942	1573120
10	201111	1573080

LEGEND:

- EXIST. WATER LINE
- EXISTING GABIONS
- EXISTING BENCHMARK
- PROPOSED FORCE MAIN
- PROPERTY LINE
- EXISTING FENCE
- EXISTING CONTOUR
- EXISTING DITCH
- MW-20 EXISTING MONITORING WELL

NOTES:

1. TOPOGRAPHIC CONTOURS SHOWN ON THIS DRAWING WERE OBTAINED FROM CONTRACT DRAWINGS FOR REMEDIAL ACTION. NOT ALL CONTOURS HAVE BEEN UPDATED TO REFLECT AS-BUILT INFORMATION.
2. THIS DRAWING DEPICTS THE CONSTRUCTION AREA IN ITS ENTIRETY. DETAILED INFORMATION FOR THE FORCE MAIN LAYOUT IS PROVIDED ON THE REFERENCED DRAWINGS.
3. CONTRACTOR SHALL USE CAUTION WHEN WORKING IN THE VICINITY OF OVERHEAD POWER LINES AND OTHER UTILITIES, AND SHALL OBSERVE SAFE WORK PRACTICES.
4. CONTRACTOR SHALL PROTECT EXISTING GABIONS BETWEEN ALIGNMENT POINTS 5 AND 6. GABIONS THAT ARE DAMAGED SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE.
5. FORCE MAIN ALINGMENT MAY REQUIRE ADJUSTMENT, DEPENDING ON SITE CONDITIONS. ALIGNMENT ADJUSTMENTS SHALL BE APPROVED BY THE ENGINEER. INSTALL ELBOW FITTINGS AT INDICATED LOCATIONS. AT OTHER PIPE BENDS, INSTALL ELBOWS OR BEND PIPE TO MINIMUM RADIUS IN ACCORDANCE WITH PIPE MANUFACTURER'S SPECIFICATIONS.

SCALE IN FEET
0 100 200

THESE DRAWINGS HAVE BEEN REVISED TO RECORD CHANGES MADE DURING CONSTRUCTION BASED ON AVAILABLE INFORMATION, AND DO NOT NECESSARILY REFLECT ALL DETAILS OF THE PROJECT AS ACTUALLY BUILT.

SURVEYED COORDINATES FOR FORCE MAIN, MONUMENTS AND LEACHATE LIFT STATION WERE PROVIDED BY FORCE MAIN CONTRACTOR'S SURVEYOR.

REV	DATE	BY	SUB	APP	DESCRIPTION
3	3/2/01	SAL	JLS	VCD	CONSTRUCTION REVISIONS
2	8/7/00	SAL	JLS	VCD	RELEASED FOR CONSTRUCTION
1	5/19/00	SAL	JLS	VCD	REISSUED FOR BIDDING

DESIGNED S.A. LIND
DRAWN C. BUDSOCK/M. ZUNIGA
CHECKED J. STUDER
IN CHARGE J. STUDER
DATE 10 AUG 99

SMITH'S FARM OPERABLE UNITS ONE AND TWO

BULLITT COUNTY, KENTUCKY

APPROVED

LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

OU1 LEACHATE ROUTING

FIGURE 6

SCALE: AS SHOWN
CONTRACT: 12000-8-0206
DWG. NO.: CL-001
REV: 3
PAGE NO: 3

XREF:
CADD FILE: J:\smith~ou2\as-built\gl-main1.dwg 3/2/01 10:38 am
PLOT DATE:

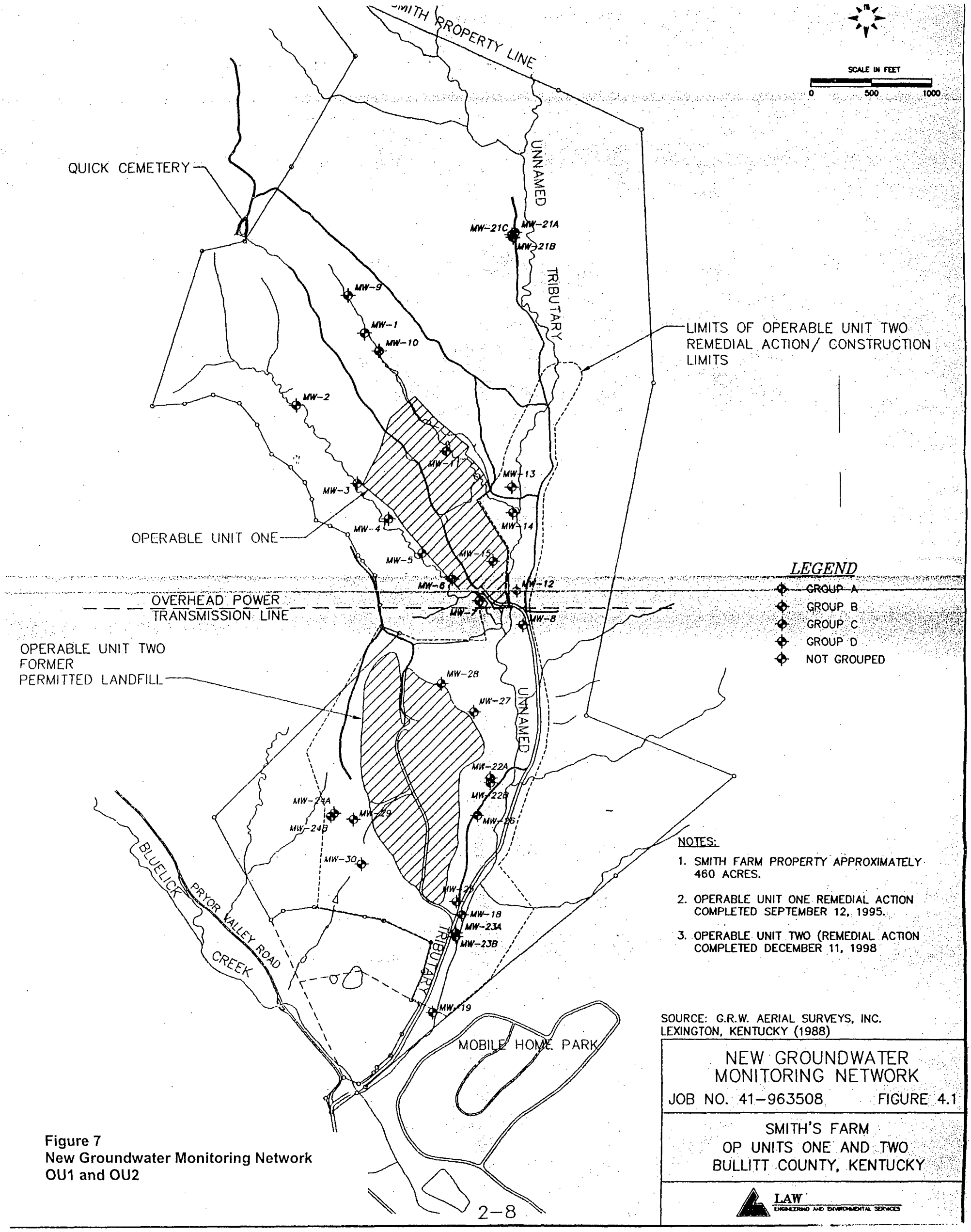


Figure 7
New Groundwater Monitoring Network
OU1 and OU2

STREAM NUMBER / STREAM IDENTIFIER	Units	1 (**) System Influent	2 24% NH_4OH	3 75% H_3PO_4	4 Air Stream	5 SBR Outlet	6 SBR Sludge Waste	7 20% NaOH	8 0.1% Polymer	9 HR Sludge Out	10 93.19% H_2SO_4	11 Air Stripper Feed Tank Inlet	12 Stripper – Inlet	13 Stripper – Outlet	14 Air Stream	15 Carbon – Out	16 Sludge C. Feed	17 Sludge Thickening Tank Out	18 (*) Solids from Press	19 Filtrate
FLOW RATE	GPM	20.00	0.0118	0.0005	407 cfm	22.69	0.36	0.0371	0.0113	2.50	0.0032	20.25	20.25	20.25	350 cfm	20.25	0.21	1.64	---	3.04
TOTAL MASS FLOW	#/HR	10,008.0	5.3	0.4	---	11,354.9	179.2	22.6	5.7	1,259.3	2.9	8,769.9	8,769.9	8,769.9	---	8,769.9	111.51	415.7	39.6	1,520.5
METALS AND SOLIDS																				
BARIUM	ug/L	800	0	0	---	800	---	0	0	---	0	150	150	150	---	---	---	---	---	---
CHROMIUM	ug/L	12	0	0	---	12	---	0	0	---	0	7	7	7	---	---	---	---	---	---
IRON	ug/L	140,000	0	0	---	140,000	---	0	0	---	0	560	560	560	---	---	---	---	---	---
MAGNESIUM	ug/L	80,000	0	0	---	80,000	---	0	0	---	0	42,000	42,000	42,000	---	---	---	---	---	---
NICKEL	ug/L	190	0	0	---	190	---	0	0	---	0	44	44	44	---	---	---	---	---	---
ZINC	ug/L	48	0	0	---	48	---	0	0	---	0	20	20	20	---	---	---	---	---	---
THALLIUM	ug/L	56	0	0	---	56	---	0	0	---	0	23	23	23	---	---	---	---	---	---
ARSENIC	ug/L	36	0	0	---	36	---	0	0	---	0	25	25	25	---	---	---	---	---	---
LEAD, TOTAL	ug/L	7	0	0	---	7	---	0	0	---	0	4	---	4	---	---	---	---	---	---
BOD	mg/L	2,600	---	---	---	500 (est)	---	0	---	---	0	500 (est)	500 (est)	500 (est)	---	---	---	---	---	---
TOTAL SUSPENDED SOLIDS	ug/L	160,000	---	---	---	---	---	---	---	---	---	10,000	10,000	10,000	---	---	---	---	---	---
% SOLIDS	%	0.4%	---	---	---	0.4%	1.0%	---	---	2.0%	---	0.1%	0.1%	0.1%	---	---	6.5%	4.0%	40.0%	---
VOLATILE COMPOUNDS																				
METHYLENE CHLORIDE	ug/L	2,900	0	0	---	---	---	0	0	---	0	2,900	2,900	5	---	5	---	---	---	---
1,1 DICHLOROETHANE	ug/L	430	0	0	---	---	---	0	0	---	0	430	430	5	---	5	---	---	---	---
1,2 DICHLOROETHENE, TOTAL	ug/L	80	0	0	---	---	---	0	0	---	0	80	80	5	---	5	---	---	---	---
1,2 DICHLOROETHANE	ug/L	220	0	0	---	---	---	0	0	---	0	220	220	5	---	5	---	---	---	---
1,2 DICHLOROPROPANE	ug/L	180	0	0	---	---	---	0	0	---	0	180	180	5	---	5	---	---	---	---
TRICHLOROETHENE	ug/L	380	0	0	---	---	---	0	0	---	0	380	380	5	---	5	---	---	---	---
BENZENE	ug/L	140	0	0	---	---	---	0	0	---	0	140	140	5	---	5	---	---	---	---
1,1,2- TRICHLOROETHANE	ug/L	260	0	0	---	---	---	0	0	---	0	260	260	5	---	5	---	---	---	---
TETRACHLOROETHANE	ug/L	130	0	0	---	---	---	0	0	---	0	130	130	5	---	5	---	---	---	---
TOLUENE	ug/L	3,600	0	0	---	---	---	0	0	---	0	3,600	3,600	5	---	5	---	---	---	---
ETHYL BENZENE	ug/L	280	0	0	---	---	---	0	0	---	0	280	280	5	---	5	---	---	---	---
1,2 DICHLOROBENZENE	ug/L	110	0	0	---	---	---	0	0	---	0	110	110	5	---	5	---	---	---	---
1,4 DICHLOROBENZENE	ug/L	220	0	0	---	---	---	0	0	---	0	220	220	5	---	5	---	---	---	---
PHENOL	ug/L	29,000	0	0	---	---	---	0	0	---	0	29,000	29,000	29,000 ***	---	5	---	---	---	---
2,4 DIMETHYLPHENOL	ug/L	7,400	0	0	---	---	---	0	0	---	0	7,400	7,400	7,400 ***	---	5	---	---	---	---
BUTYL BENZYL PHTHALATE	ug/L	15	0	0	---	---	---	0	0	---	0	15	15	15 ***	---	5	---	---	---	---

NOTES:

* = TOTAL MASS FLOW REPORTED IN POUNDS PER DAY FOR THE SLUDGE BASED UPON CONVERSION OF THE METAL TO THE HYDROXIDATE AND ACTIVATED SLUDGE AT 40 WT% SOLID WITH D.E. PRECOAT.

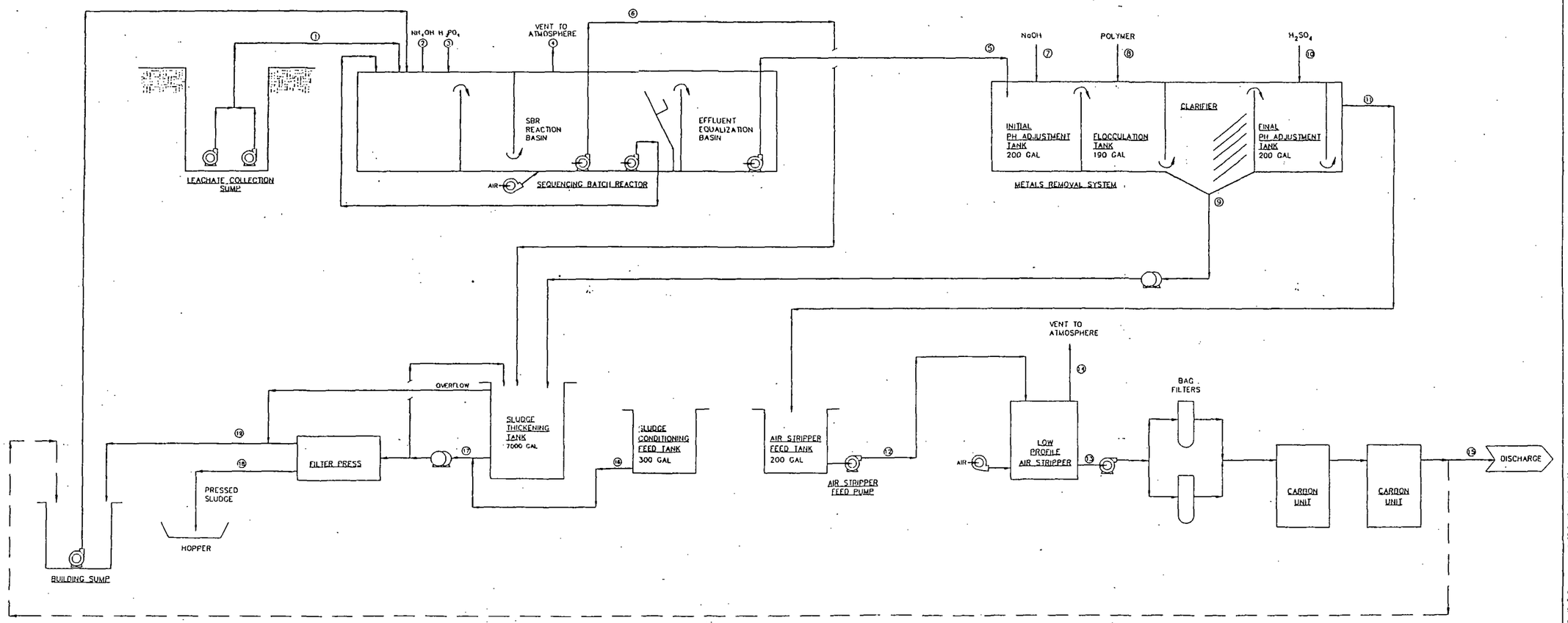
** – CONCENTRATIONS BASED UPON "TREATABILITY STUDY FOR LEACHATE FROM SMITH'S FARM OPERABLE UNIT TWO LANDFILL SITE", APRIL 1995.

*** = THESE COMPOUNDS ARE NOT SIGNIFICANTLY REMOVED BY AIR STRIPPING. EFFLUENT CONCENTRATION ASSUMED EQUAL TO INFLUENT CONCENTRATION AS A MAXIMUM.

GPM = GALLONS PER MINUTE

#/HR = POUNDS PER HOUR

ug/L = MICROGRAMS PER LITER



REVISIONS				DESCRIPTION	REVISIONS				DESCRIPTION	DESIGNED	
										DRAWN	
										CHECKED	
										IN CHARGE	
										DATE	15 NOV 95

SMITH'S FARM OPERABLE UNIT TWO
BULLITT COUNTY, KENTUCKY

SUBMITTED _____ APPROVED _____

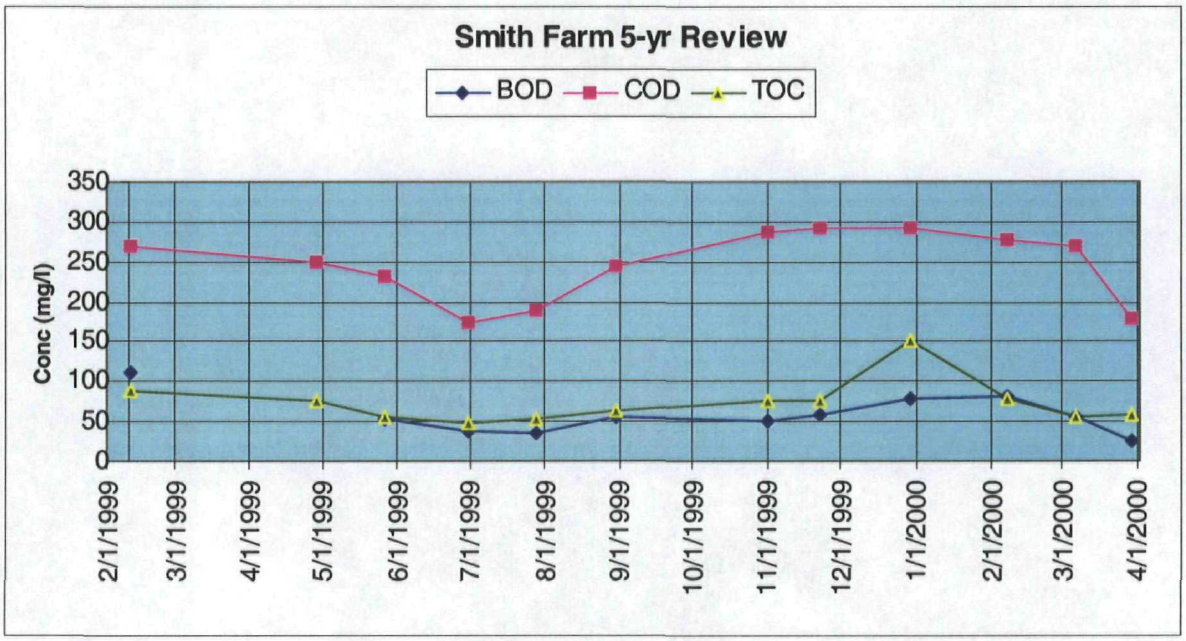
LAW ENGINEERING AND ENVIRONMENTAL SERVICES, INC.

Figure 8
Process Flow Diagram

SCALE: NONE
CONTRACT: 41-963508
SUB NO: PI-002 | REVISION NO: 0 | PAGE NO: 63

CADD FILE: /b462/sw1n2/mECn/p-flow PLOT DATE: 11/14/95

Figure 9 Loading Trend to Plant



Appendix A

Documents Reviewed

1. Record of Decision, Smith's Farm Superfund Site, Operable Unit Two, Shepherdsville, Bullitt County, Kentucky, (EPA, September 14, 1993)

2. Smith's Farm, NPL Site Summary, USEPA, http://www.epa.gov/region04/waste/npl/nplky/smifrmky.htm

3. Smith's Farm,Record of Decision (ROD) Abstract, USEPA, http://www.epa.gov/superfund/sites/rodsites/0402059.htm

4. Site KDEP Effluent Discharge Criteria, Kentucky Department for Environmental Protection, July 06, 1998.

5. Draft Remedial Action & Final Construction Report, Smith's Farm Superfund Site, Operable Unit Two, LawGibb Group, March, 1999.

6. Site Operation and Maintenance Manual, Remedial Action-Smith's Farm, Operable Unit Two, Bullitt County, Kentucky, March 1999.

7. Treatment Plant Operation and Maintenance Manual, Smith's Farm, Operable Unit Two, Bullitt County, Kentucky, September 01, 1999.

8. Annual O&M Report 1999, Smith's Farm, Operable Units One and Two, Bullitt County, March 2000.

9. Annual O&M Report 2000, Smith's Farm, Operable Units One and Two, Bullitt County, March 2001.

Appendix B

5-Year Review Site Visit
Date: 24 July 2001
Location: Smith's Farm Landfill
Brooks, Bullitt County, KY

ATTENDEES					
Name/Title	Organization	Address	Phone	Fax	E-mail
Al Scalzo, P.E., Env. Engineer	USACE Louisville, Engineering Division	P.O. Box 59 Louisville, KY 40201-0059	502-315-6309	502-315-6309	Albert.M.Scalzo@LRL02.usace.army.mil
Richard Kennard, Env. Geologist	USACE Louisville Engineering Division	P.O. Box 59 Louisville, KY 40201-0059	502-315-6323	502-315-6309	Richard.A.Kennard@LRL02.usace.army.mil
Lindsey K. Lien, Environmental Engineer	USACE Omaha HTRW-CX	12565 W. Center Rd Omaha, NE 68144	402-697-2580	402-697-2595	lindsey.k.lien@usace.army.mil
Miller Moor, DA Intern	USACE Louisville Engineering Division	P.O. Box 59, Louisville, KY 40201-0059	502-315-6319	502-315-6309	miller.moore@LRN02.usace.army.mil
Rob Bocarro Project Manager	Law Engineering & Environmental Services	3200 Town Point Dr. NW, Suite 100, Kennesaw, GA 30144	770-421-7013	770-421-3486	rbocarro@lawco.com
Jason Ross	Law Engineering & Environmental Services.	13425 East Point Center Dr. Louisville, KY 40222	502-253-2548	502-253-2501	jross@lawco.com
Eddie Taylor	Law Engineering & Environmental Services.	13225 Town Park Dr., Louisville, KY 40223	502-253-2500	502-253-2501	etaylor@lawco.com

Appendix C

Site Inspection Checklists

Five-Year Review Site Inspection Checklist

Purpose of the Checklist

The site inspection checklist provides a method for collecting essential information during the site inspection portion of the five-year review. The checklist serves as a reminder of what information needs to be gathered and provides the means of checking off information obtained and reviewed, or information not available or applicable. The checklist is divided into sections as follows:

I. Site Information
II. Interviews
III. Onsite Documents & Records Verified
IV. O&M Costs
V. Access and Institutional Controls
VI. General Site Conditions
VII. Landfill Covers
VIII. Vertical Barrier Walls
IX. Groundwater/Surface Water Remedies
X. Other Remedies
XI. Overall Observations

Please provide or have available the following at the time of the Site Visit/Inspection: Sampling results, costs, and maintenance reports. The attached checklist focuses on the two most common types of remedies that are subject to five-year reviews: **landfill covers**, and groundwater pump and treatment remedies. Sections are also provided for surface water collection and monitored natural attenuation. ***Sections of the checklist that are not applicable to your site will not be covered.***

Please complete and have backup information for as many sections in advance of the site inspection. This is important to document site status. Please note that the checklist is not meant to be completely definitive or restrictive; additional information may be supplemented as necessary. Also, we may document actual site conditions with photographs.

Using the Checklist for Types of Remedies

The checklist has sections designed to capture information concerning the main types of remedies, which are found at sites requiring five-year reviews. These remedies are **landfill covers** (Section VII of the checklist) and groundwater and surface water remedies (Section IX). The primary elements and appurtenances for these remedies are listed in sections that can be checked off as the facility is inspected. The opportunity is also provided to note conditions, write comments on the facilities, and attach additional information.

Considering Operation and Maintenance Costs

Unexpectedly widely varying or unexpectedly high O&M costs can be early indicators of remedy failure. For this reason, it is important to provide a record of the original O&M cost estimate and of annual O&M costs during the years for which costs are available. Section IV of the checklist provides a place for documenting annual costs and for commenting on unanticipated or unusually high O&M costs. A more **detailed categorization of costs should** be attached to the checklist if available. Examples of categories of O&M costs are listed below.

Operating Labor - This includes all wages, salaries, training, overhead, and fringe benefits associated with the labor needed for operation of the facilities and equipment associated with the remedial actions.

Maintenance Equipment and Materials - This includes the costs for equipment, parts, and other materials required to perform routine maintenance of facilities and equipment associated with a remedial action.

Maintenance Labor - This includes the costs for labor required to perform routine maintenance of facilities and for equipment associated with a remedial action.

Auxiliary Materials and Energy - This includes items such as chemicals and electricity needed for plant operation, water and sewer service, and fuel costs.

Purchased Services - This includes items such as sampling costs, laboratory fees, and other professional services for which the need can be predicted.

Administrative Costs - This includes all costs associated with administration of O&M not included under other categories, such as labor overhead.

Insurance, Taxes and Licenses - This includes items such as liability and sudden and accidental insurance, real estate taxes on purchased land or right-of-way, licensing fees for certain technologies, and permit renewal and reporting costs.

Other Costs - This includes all other items that do not fit into any of the above categories. Discuss and cost effective measures implemented in the past and/or recommendations for cost savings to owner or Government without sacrificing protectiveness.

Five-Year Review Site Inspection Checklist

(Information may be completed by hand. Some information will be completed by COE. "N/A" refers to "not applicable.")

I. SITE INFORMATION

Site name: Smith's Farm, Pryor Valley Road, Brooks KY 40165 **Date of inspection:** 7/24/2001
Location and Region: 04 **EPA ID:** KYD097267413
Agency, office, or company leading the five-year review: Corps of Engineers, Louisville District **Weather/temperature:** 9 Hot 92°F

Remedy Includes: (Check all that apply)

- ✓ Landfill cover/containment
- ✓ Leachate collection and transmission system
- ✓ Leachate treatment system
- ✓ Treated Effluent Disposal system
- ✓ Access controls
- ✓ Institutional controls
- __ Groundwater pump and treatment
- __ Surface water collection and treatment
- __ Other _____

Attachments: __ Inspection team roster attached __ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** Robert Andrew Bocarro (Name) Project Manager (Title) 7/24/01 (Date)
Interviewed ✓ at site __ at office __ by phone Phone no. _____
Problems, suggestions; __ Report attached _____
The above is Law's project manager

2. **O&M staff** Eadie Taylor (Name) Chief Operator (Title) Ed Berger (Name) Assistant Operator (Title) Jason Ross, PE (Name) Kentucky certifying Engineer / Co-ordinator (Title) (Date)
Interviewed ✓ at site __ at office __ by phone Phone no. _____
Problems, suggestions; __ Report attached _____
The above are Law Engineering and Environmental Services, Inc staff, from the Louisville office

3. **Local regulatory authorities and response agencies** (i.e., State offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency Kentucky EPD.
Contact Rick Horan (Name) _____ (Title) _____ (Date) _____ (Phone no.)
Problems; suggestions; __ Report attached _____
Visited site in June 2001

Agency EPA
Contact Tony De Angelo RPM Environmental Manager
Name Title Date Phone no.
Problems; suggestions; __ Report attached

Agency
Contact
Name Title Date Phone no.
Problems; suggestions; __ Report attached

Agency
Contact
Name Title Date Phone no.
Problems; suggestions; __ Report attached

4. **Other interviews** (optional) __ Report attached. N/A.

III. ONSITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
✓ O&M manual ✓ Readily available __ Up to date __ N/A
✓ As-built drawings ✓ Readily available __ Up to date __ N/A
✓ Maintenance logs ✓ Readily available __ Up to date __ N/A
Remarks Logs prepared M, W and F

2. **Site-Specific Health and Safety Plan** ✓ Readily available __ Up to date __ N/A
__ Contingency plan/emergency response plan __ Readily available __ Up to date __ N/A
Remarks

3. **O&M and OSHA Training Records** ✓ Readily available __ Up to date __ N/A
Remarks OSHA registered.

4. **Permits and Service Agreements**
__ Air discharge permit __ Readily available __ Up to date ✓ N/A
✓ Effluent discharge __ Readily available __ Up to date __ N/A
__ Waste disposal, POTW __ Readily available __ Up to date __ N/A
__ Other permits __ Readily available __ Up to date __ N/A
Remarks

5. **Gas Generation Records** __ Readily available __ Up to date ✓ N/A
Remarks Not required.

6. **Settlement Monument Records** ✓ Readily available __ Up to date __ N/A
Remarks_____

7. **Groundwater Monitoring Records** ✓ Readily available __ Up to date __ N/A
Remarks_____

8. **Leachate Extraction Records** ✓ Readily available __ Up to date __ N/A
Remarks_____

9. **Discharge Compliance Records**
__ Air __ Readily available __ Up to date ✓ N/A
✓ Water (effluent) ✓ Readily available __ Up to date __ N/A
Remarks_____

10. **Daily Access/Security Logs** __ Readily available __ Up to date __ N/A
Remarks_____

IV. O&M COSTS

1. **O&M Organization**
__ State in-house __ Contractor for State
✓ PRP in-house __ Contractor for PRP
Other_____

2. **O&M Cost Records**
✓ Readily available ✓ Up to date
__ Funding mechanism/agreement in place
Original O&M cost estimate $685 000 (1999) __ Breakdown attached

Total annual cost by year for review period if available

From JAN 1999 (Date)	To DEC 99 (Date)	$410,000 (Total cost)	__ Breakdown attached	Breakdown given to AI Scalzo.
From JAN 2000 (Date)	To DEC 2000 (Date)	$367,000 (Total cost)	__ Breakdown attached	
From JAN 2001 (Date)	To JUL 2001 (Date)	$270,000 (Total cost)	__ Breakdown attached	
From _____ (Date)	To _____ (Date)	_____ (Total cost)	__ Breakdown attached	
From _____ (Date)	To _____ (Date)	_____ (Total cost)	__ Breakdown attached	

3. **Unanticipated or Unusually High O&M Costs During Review Period**
Describe costs and reasons: Costs have been reducing based on first 2 years of operation

V. ACCESS AND INSTITUTIONAL CONTROLS ✓ Applicable __ N/A

A. Fencing

1. **Fencing damaged** __ Location shown on site map __ Gates secured __ N/A
Remarks Repairs carried out in June 2001

B. Other Access Restrictions

1. **Signs and other security measures** ✓ Location shown on site map __ N/A
Remarks

C. Institutional Controls

1. **Implementation and enforcement**
Site conditions imply ICs not properly implemented __ Yes ✓ No __ N/A
Site conditions imply ICs not being fully enforced __ Yes ✓ No __ N/A

Type of monitoring (e.g., self-reporting, drive by) SELF-REPORTING
Frequency ANNUALLY
Responsible party/agency EPA
Contact TONY DE ANGELO (Name) RPM Env. Manager (Title) (Date) (404) 562-8826 (Phone no.)

Reporting is up-to-date ✓ Yes __ No __ N/A
Reports are verified by the lead agency ✓ Yes __ No __ N/A

Specific requirements in deed or decision documents have been met ✓ Yes __ No __ N/A
Violations have been reported __ Yes __ No ✓ N/A
Other problems or suggestions: __ Report attached

2. **Adequacy** __ ICs are adequate __ ICs are inadequate __ N/A
Remarks AGENCY MUST COM

D. General

1. **Vandalism/trespassing** ✓ Location shown on site map ✓ No vandalism evident
Remarks Some instances of vandalism of fencing and trespassing

2. **Land use changes onsite** ✓ N/A
Remarks

3. **Land use changes offsite** ✓ N/A
Remarks

VI. GENERAL SITE CONDITIONS

A. Roads ✓ Applicable __ N/A

1. **Roads damaged** ✓ Location shown on site map __ Roads adequate __ N/A
Remarks CROCODILE CRACKING ~~OF AGE~~ ALONG ACCESS ROAD TO OU-1
OTHER ACCESS ROADS IN GOOD CONDITION

B. Other Site Conditions

Remarks
OU-2 AND OU-1 IN GOOD CONDITION.
COVER VEGETATION WAS MOWED IN JUNE 2001.
FENCE IN GOOD CONDITION.

VII. LANDFILL COVERS __ Applicable __ N/A

A. Landfill Surface

1. **Settlement** (Low spots) __ Location shown on site map ✓ Settlement not evident
Areal extent ____ Depth ____
Remarks

2. **Cracks** __ Location shown on site map ✓ Cracking not evident
Lengths ____ Widths ____ Depths ____
Remarks

3. **Erosion** __ Location shown on site map ✓ Erosion not evident
Areal extent ____ Depth ____
Remarks DRAINAGE IMPROVEMENTS AND REPAIRS CARRIED OUT IN 2000/2001

4. **Holes** __ Location shown on site map ✓ Holes not evident
Areal extent ____ Depth ____
Remarks

5. **Vegetative Cover** __ Grass ✓ Cover properly established __ No signs of stress
__ Trees/Shrubs (indicate size and locations on a diagram)

Remarks_____

_____

6. **Alternative Cover (armored rock, concrete, etc.)** __ N/A
Remarks_____

7. **Bulges** __ Location shown on site map ✓ Bulges not evident
Areal extent_____ Height_____
Remarks_____

_____

8. **Wet Areas/Water Damage** ✓ Wet areas/water damage not evident
__ Wet areas __ Location shown on site map Areal extent_____
__ Ponding __ Location shown on site map Areal extent_____
__ Seeps __ Location shown on site map Areal extent_____
__ Soft subgrade __ Location shown on site map Areal extent_____
Remarks_____

9. **Slope Instability** __ Slides __ Location shown on site map ✓ No evidence of slope instability
Areal extent_____
Remarks_____

B. Benches ✓ Applicable __ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** __ Location shown on site map ✓ N/A or okay
Remarks_____

_____

2. **Bench Breached** __ Location shown on site map ✓ N/A or okay
Remarks_____

_____

3. **Bench Overtopped** __ Location shown on site map ✓ N/A or okay
Remarks_____

_____

C. Letdown Channels __ Applicable ✓ N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** __ Location shown on site map ✓ No evidence of settlement
Areal extent_____ Depth_____
Remarks_____

_____

2. **Material Degradation** __ Location shown on site map ✓ No evidence of degradation
Material type_____ Areal extent_____
Remarks_____

3. **Erosion** __ Location shown on site map ✓ No evidence of erosion
Areal extent_____ Depth_____
Remarks_____

4. **Undercutting** __ Location shown on site map ✓ No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____

5. **Obstructions** Type_____ ✓ No obstructions
__ Location shown on site map Areal extent_____
Size_____
Remarks_____

6. **Excessive Vegetative Growth** Type_____
✓ No evidence of excessive growth
__ Vegetation in channels does not obstruct flow
__ Location shown on site map Areal extent_____
Remarks_____

D. Cover Penetrations ✓ Applicable __ N/A

1. **Gas Vents** __ Active ✓ Passive
✓ Properly secured/locked ✓ Functioning __ Routinely sampled __ Good condition
__ Evidence of leakage at penetration __ Needs O&M __ N/A
Remarks * SOME VENT PIPES WERE INSTALLED SUCH THAT THE PIPES LEANED. REFER TO GAS CONTROL PLAN CL-010.

2. **Gas Monitoring Probes**
__ Properly secured/locked __ Functioning __ Routinely sampled __ Good condition
__ Evidence of leakage at penetration __ Needs O&M ✓ N/A
Remarks NOT SAMPLED TO DATE.

3. **Monitoring Wells** (within surface area of landfill)
✓ Properly secured/locked __ Functioning __ Routinely sampled __ Good condition
__ Evidence of leakage at penetration __ Needs O&M __ N/A
Remarks_____

4. **Leachate Extraction Wells**
✓ Properly secured/locked __ Functioning __ Routinely sampled __ Good condition
__ Evidence of leakage at penetration __ Needs O&M __ N/A
Remarks_____

5. **Settlement Monuments** __ Located ✓ Routinely surveyed __ N/A
Remarks MONITOR ANNUALLY IN JANUARY 2001

E. Gas Collection and Treatment __ Applicable ✓ N/A

1. **Gas Treatment Facilities**
__ Flaring __ Thermal destruction __ Collection for reuse
__ Good condition __ Needs O&M
Remarks_____

2. **Gas Collection Wells, Manifolds and Piping**
__ Good condition __ Needs O&M
Remarks_____

3. **Gas Monitoring Facilities** (e.g., gas monitoring of adjacent homes or buildings)
__ Good condition __ Needs O&M __ N/A
Remarks_____

F. Cover Drainage Layer ✓ Applicable __ N/A

1. **Outlet Pipes Inspected** ✓ Functioning __ N/A
Remarks_____

2. **Outlet Rock Inspected** __ Functioning ✓ N/A
Remarks_____

G. Detention/Sedimentation Ponds __ Applicable ✓ N/A

1. **Siltation** Areal extent_____ Depth_____ __ N/A
__ Siltation not evident
Remarks_____

2. **Erosion** Areal extent_____ Depth_____
✓ Erosion not evident
Remarks_____

3. **Outlet Works** ✓ Functioning __ N/A
Remarks_____

4. **Dam** __ Functioning ✓ N/A
Remarks_____

X **H. Retaining Walls** ✓ Applicable __ N/A Op UNIT ONE ONLY

1. **Deformations** __ Location shown on site map ✓ Deformation not evident
Horizontal displacement_____ Vertical displacement_____
Rotational displacement_____

Remarks_____

_____

2. **Degradation** __ Location shown on site map ✓ Degradation not evident
Remarks_____

_____

I. Perimeter Ditches/Off-Site Discharge ✓ Applicable __ N/A

1. **Siltation** __ Location shown on site map ✓ Siltation not evident
Areal extent_____ Depth_____
Remarks_____

_____

2. **Vegetative Growth** __ Location shown on site map __ N/A
✓ Vegetation does not impede flow
Areal extent_____ Type_____
Remarks_____

_____

3. **Erosion** __ Location shown on site map ✓ Erosion not evident
Areal extent_____ Depth_____
Remarks_____

_____

4. **Discharge Structure** ✓ Functioning __ N/A
Remarks_____

_____

VIII. VERTICAL BARRIER WALLS __ Applicable ✓ N/A

1. **Settlement** __ Location shown on site map __ Settlement not evident
Areal extent_____ Depth_____
Remarks_____

_____

2. **Performance Monitoring** Type of monitoring_____
__ Performance not monitored
Frequency_____ __ Evidence of breaching
Head differential_____
Remarks_____

IX. GROUNDWATER/SURFACE WATER REMEDIES ✓ Applicable __ N/A

A. **Groundwater Extraction Wells, Pumps, and Pipelines** ✓ Applicable __ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
✓ Good condition ✓ All required wells located __ Needs O&M G N/A
Remarks_____
REFER TO CL-006 FOR DETAILS.

_____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
✓ Good condition __ Needs O&M
Remarks_____

3. **Spare Parts and Equipment**
✓ Readily available __ Good condition __ Requires upgrade __ Needs to be provided
Remarks_____
AT TREATMENT PLANT

B. Surface Water Collection Structures, Pumps, and Pipelines __ Applicable ✓ N/A

1. **Collection Structures, Pumps, and Electrical**
__ Good condition __ Needs O&M
Remarks_____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
__ Good condition __ Needs O&M
Remarks_____

3. **Spare Parts and Equipment**
__ Readily available __ Good condition __ Requires upgrade __ Needs to be provided
Remarks_____

C. Treatment System ✓ Applicable __ N/A

1. **Treatment Train** (Check components that apply)
✓ Metals removal __ Oil/water separation ✓ Bioremediation
✓ Air stripping ✓ Carbon adsorbers
Filters PAC
__ Additive (e.g., chelation agent, flocculent)_____
Others _____
✓ Good condition __ Needs O&M
✓ Sampling ports properly marked and functional
✓ Sampling/maintenance log displayed and up to date
✓ Equipment properly identified
✓ Quantity of groundwater treated annually 1 517 339 gallons in 2000 1 527 743 in 1999
✓ Quantity of surface water treated annually N/A
Remarks_____

2. **Electrical Enclosures and Panels** (properly rated and functional)
__ N/A ✓ Good condition __ Needs O&M
Remarks_____

3. **Tanks, Vaults, Storage Vessels**
__ N/A ✓ Good condition __ Proper secondary containment __ Needs O&M
Remarks_____

4. **Discharge Structure and Appurtenances**
__ N/A ✓ Good condition __ Needs O&M
Remarks_____

5. **Treatment Building(s)**
__ N/A ✓ Good condition (esp. roof and doorways) __ Needs repair
__ Chemicals and equipment properly stored
Remarks_____

6. **Monitoring Wells** (pump and treatment remedy)
✓ Properly secured/locked __ Functioning __ Routinely sampled __ Good condition
__ All required wells located __ Needs O&M __ N/A
Remarks_____

D. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
✓ Properly secured/locked ✓ Functioning ✓ Routinely sampled ✓ Good condition
✓ All required wells located __ Needs O&M __ N/A
Remarks_____

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).

OU-2 remedy was designed to contain contaminated, on-site surface soils, groundwater and leachate.

Cap is effective especially since drainage improvements have been made. OU-2 Treatment Plant has been proven to be highly effective at treating and removal of volatile and semi-volatile organics and metals

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.

Since 1999 Law has been responsible for O&M of OU-1 and OU-2. Law has a Chief Operator (Licensed in Kentucky) and an assistant operator who operate the Treatment Plant and monitor and maintain OU-1 and OU-2 three days per week: on Mondays, Wednesdays and Fridays. The operator responses to call outs are not due to plant outages on weekends and after hours. The operational staff have played a key role in terms of meeting the O&M requirements of the ROD

C. Early Indicators of Potential Remedy Failure

Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggests that the protectiveness of the remedy may be compromised in the future.

O&M costs have been decreasing since 1999, the year that the Treatment Plant was operated for the first time

D. Opportunities for Optimization

Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy.

LAW has been active in terms of looking at means to optimize the operation and maintenance of the Treatment Plant. Some key interventions include:

- preventative maintenance approach has reduced down time due to defective machinery. All mechanical and electrical plant is regularly serviced and maintained.
- Law ~~has~~ is constantly looking for bulk chemical suppliers to provide the best prices.
- Law's monitoring of the leachate, effluent is in compliance with the ROD requirements. In 2001, monitoring frequency has been reduced in accordance with the permit
- Law will shortly purchase mowing equipment as they have demonstrated that it is more cost effective ~~than~~ than using contractors to perform the work.
- Law ~~has also~~ will ~~reduce~~ reduce analytical laboratory costs by changing laboratory.

Treated Water Disposal Checklist

Installation Name Smith Operable Unit Two

Site Name Smith's Farm, Pryor Valley Road, Brooks, Kty 40165

Site Visit Date 7/24/01

This checklist is designed to facilitate the evaluation of options for treated water disposal.

It is divided into the following sections:
1) PRP Representatives
2) Typical treatment objectives
3) References
4) Data collection requirements
5) Adequacy of operations and maintenance
6) Alternatives for possible cost savings
7) Supplemental notes and data.

The checklist provides suggestions for information gathering, and space has been provided to record data and notes from the site visit. Supplementary notes, if required, should be numbered to correspond to the appropriate checklist sections.

1) PRP representatives in attendance
The following individuals participated in informing regarding the above-ground treatment system.

- Robert Andrew Bocarro, Project Manager, Civil and Environmental Engineer
  Name, Title, Discipline
- Ebbert Taylor, Chief Operator, Mechanical Technician/Licensed Operator
  Name, Title, Discipline
- Jason Ross, Project Co-ordinator, Civil Engineer (PE, Kentucky)
  Name, Title, Discipline

2) Typical Treatment Objectives

Verify that the objectives behind the current method of disposal are clear and still valid.

3) References
Coordinate this checklist with the checklist for the applicable treatment processes.

4) Data Collection Requirements
Record the following information about the treated water streams being discharged. Record the appropriate units with each value.

a) Sketch process flow diagram (PFD), including valves and instrument locations, on the back of this sheet or on a separate sheet.

b) Record the nameplate information from any mechanical equipment associated with the treated water discharge for future reference. Use additional sheets as necessary.

Refer to ~~O&M report for~~ Treatment Plant O&M Manual

c) Discharge requirements

Contaminant	Permitted Limit (specify units)	Sampling Frequency (specify units)
Refer to copy of permit		

d) How were the discharge requirements derived (e.g., water quality based, technology based, or other)? If not required by permit, how were the discharge limits developed? What parties or individuals were responsible for deriving the limits?

Water quality based.

e) Are the permit discharge requirements typically met? How many exceedances have there been since start-up, and which parameter(s) were exceeded?

Effluent has consistently met permit discharge requirements since commissioning in 1999. Two exceedances in 2000 as (Refer to Annual Report

f) Is Whole Effluent Toxicity (WET) testing required? What is the indicator species, and has passing WET testing been a problem?

Will need to verify with Kentucky EPD whether this is required.

5) Adequacy of Operations and Maintenance

a) Verify that the discharged effluent is being sampled and analyzed in accordance with the sampling and analysis plan designed to assure compliance with current permits and regulations. Determine if any additional monitoring is needed to assure compliance. Is an increase or decrease in process monitoring (not permit monitoring) appropriate?

Effluent is sampled and analysed in accordance with permit. As the plant has been in operation for over 18 months, the effluent is sampled quarterly

b) Verify that all controls and alarms are working. Are there provisions to notify an operator of a malfunction when the treatment unit is unattended? *(e.g., sensors in injection well vaults should be tested to ensure operators are notified if well vaults flood.)*

Controls and alarms are fully operational

6) Alternatives for Possible Cost Savings.

Other options may be available for disposal of treated water. The following questions may help determine if an alternate method should be used.

6.1) General Alternatives

a) Compare the existing treatment methods to the alternatives considered in the Feasibility Study (FS), along with any applicable innovative methods, to determine if the existing treatment is still optimal. Are any of the alternative methods more appropriate after considering the economics of the treatment process change?

Treatment system is fully effective at volatile, semi-volatile and metals removal. The plant has sufficient redundancy to handle varying leachate concentrations

b) Are there treated water reuse options that have not been previously considered?

No

c) If treated water is being injected in the aquifer, determine if any proposed changes in treatment will impact the injection performance.

N/A

d) Can the volume of contaminated water being treated be decreased through recycling, or by using partially treated water for some processes? *(If it has not already been implemented, re-use of decontamination water should be considered.)*

~~This is not possible~~ Volume of contaminated water may decrease as the cap is fully effective now that drainage improvements have been made.

e) Can the treated water be surface discharged to a nearby stream, a sanitary sewer, or transported off-site because of changed conditions, such as: decreased flow rates, decreased contaminant concentrations, or changes in the POTW's acceptance criteria? *(An NPDES permit is typically required for release into streams or other surface waters.)*

Treated water is discharged to an adjacent stream.

6.2) Surface discharge

a) Does the discharge have a NPDES (or equivalent) discharge permit? Have there been any permit excursions or Notices-of-Violation (NOVs) in the past twelve months? 06/07/99

No

b) Are any permit changes anticipated when the permit is renewed ?

N/A

c) Review the current permit to formulate potential changes to request when the permit is renewed by the issuing agency. Determine if a decrease in the parameters monitored or monitoring frequency is appropriate. If toxicity testing is currently required, determine if the test species and the dilution ratio are appropriate.

N/A

7) Supplemental Notes and Data

There are 0 pages of supplemental notes and data attached to this checklist.

Above-Ground Treatment System Performance Checklist

Site Name Smith's Farm Operable Unit Two

Site Visit Date 7/24/01

This checklist is designed to facilitate the performance evaluation of an above-ground treatment system for wastewater, groundwater, and leachate. It is divided into the following sections:

1) PRP in attendance
2) Typical treatment objectives
3) References
4) Data collection requirements
5) Performance analysis calculations
6) Adequacy of operations and maintenance
7) Typical performance problems
8) Alternatives for possible cost savings
9) Supplemental notes and data.

The checklist provides suggestions for information gathering, and space has been provided to record data and notes.

1) PRP representatives in attendance

The following individuals participated in informing regarding the above-ground treatment system.

- Robert Andrew Boccardo, Project Manager, Civil and Environmental Engineer
  Name, Title, Discipline
- Elbert Taylor, Chief Operator, ~~Pe~~ Licensed Operator
  Name, Title, Discipline
- Jason Ross, Civil Engineer, PE licensed in Kentucky.
  Name, Title, Discipline

2) Typical Treatment Objectives

Purpose is to verify that the treatment objectives established when the above-ground treatment system was designed and installed are clear and still valid. Treatment of contaminated water maybe necessary to meet regulatory requirements for surface discharge or underground injection. If treated water will be injected additional conditioning may be required to prevent clogging of injection wells and to ensure that the chemistry of the treated water is compatible with the receiving aquifer. Wastewater, groundwater, and leachate treatment systems may be operated for extended periods of time, and operational and maintenance costs can be a significant commitment over the long term. Efforts should be made to reduce operations, maintenance, and monitoring costs for the treatment system

3) References (N/A)

4) Data Collection Requirements

Record the following information needed for performance calculations and to check the operation of the treatment unit. Record the appropriate units with each value.

a) Record the nameplate information from the treatment vessels, and from pumps and other mechanical equipment for future reference.

Refer to Treatment Plant Operating Manual

b) Sketch process flow diagram (PFD), including valves and instrument locations, on the back of this sheet or on a separate sheet.

Refer to PI 1-5 Drawings

4.1 Wastewater Influent

a) Influent Sources

List the sources of contaminated water treated by this system.

Source of Water for Treatment	Source Type (e.g., wastewater, groundwater, stormwater, leachate)	Flow Rate (record units)
Leachate from Op Unit Two	Leachate	4200 gpd ; 1517339 operation
" " " " One		

b) Contaminants Treated

List the contaminants and their concentrations from each source treated. Data should be provided for at least the last 3 sampling events.

Source of Water for Treatment	Contaminant (e.g., BOD_5, TSS, TCE, Lead)	Concentration (record units)
Refer to Appendix C of Trend Analysis Report		

c) Are hazardous industrial chemicals listed in Section 313 of 40 CFR Part 372 (i.e., contact or non-contact) present in stormwater containment vessels?

No

4.2 Discharge and Disposal

a) Where is treated water discharged? (e.g., surface water, POTW, injection)

Surface water

b) List discharge permit(s) (e.g., NPDES, permit by rule {POTW}) and include the permit number, issuing agency, and expiration date.

Copy of permit was issued to Corps of Engineers on site

c) Treated Water Discharges

Water or Waste Stream	Treatment	Discharged Flow
Op Unit One leachate	Organic removal by biological treatment in SBR, settling, metals removal, air stripping to remove volatiles and carbon filters for final polishing	
Op Unit Two "		
	Total Discharged Flow =	1.27 M gallons per annum.

d) Describe other on-site waste management, if present. (e.g., sludge disposal)

Sludge is disposed on a monthly basis. Sludge is from filter belt presses. A TCLP analysis to establish whether sludge is hazardous or non-hazardous.

4.3 Wastewater Treatment Operations

a) What is the design basis for the above-ground portion of the water treatment system? (e.g., minimum and maximum influent flow, influent concentrations, operating hours per day, expected downtime)

Maximum influent flow was determined by model to predict leachate flow.

b) For each of the last 12 months of operation, provide the following information:

- Total volume of water treated.
- Total hours of down time.
- Amounts of consumable materials used in the treatment processes (e.g., acid, caustic, sequestering agents, coagulants, activated carbon).
- Quantities of secondary waste products generated (e.g., sludge, spent activated carbon).
- The number of operators, and the number of hours present, at the treatment system facility.
- Itemized costs of operation (significant cost items only) ranked from highest to lowest, including waste disposal costs.

Refer to 2000 Annual Report

4.4 Air Emission Sources (if applicable)

a) Do any process chemicals used for treatment pose an air emissions problem? Can alternative chemicals be substituted?

N/A

b) Are fugitive emissions a problem? What is the source (or sources)?

N/A

c) Is there a regulated source (or sources) of air emissions at the project site?

N/A

4.5 Air Emission Discharge

a) Were emissions limits set by regulation (e.g., NESHAP MACT, BACT, LAER, etc), or established based upon risk to downwind receptors (e.g., specified in a ROD)? What parties were responsible for deriving the limits?

N/A

b) What is the sampling location (e.g., stack, site perimeter)?

N/A

c) Air emissions limits

Contaminant	**Permitted Limit** (specify units)	**Sampling Frequency** (specify units)
N/A		

d) Are the permit limits typically met? How many exceedances since start-up, and which parameter(s) were exceeded?

N/A

4.6 Air Emission Control

a) Are air emissions treated prior to release to the atmosphere? What treatment is provided? If emission limits are approached, is there a contingency plan to modify operational procedures to reduce emissions and prevent exceedances of regulatory limits?

N/A

5) Performance Analysis Calculations

a) Are influent contaminant concentrations increasing, decreasing, or remaining stable? Evaluate each water source separately.

Refer to trend analysis report

b) Plot the concentrations of the contaminants of concern before and after each unit process in the treatment system. Describe significant trends. (Data should be provided for at least the last 3 sampling events.)

Refer to trend analysis report

6) Adequacy of Operations and Maintenance

a) Verify that equipment is maintained per manufacturers recommendations and that controls and alarms are working. Are there provisions to notify an operator of a malfunction when the unit is unattended?

Equipment is very well maintained. The plant has PLC's which include a 'chatter box' to inform the operator about malfunctions.

b) Verify that the effluent concentration is sampled and analyzed in accordance with the sampling and analysis plan designed to assure the system is operating within permitted limits. Are measurements made with appropriate frequency? Determine if any additional monitoring is needed to analyze the operating conditions. *(Reason: The frequency of monitoring may require adjustments due to changes in the chemistry of the influent or other factors. More frequent monitoring may be needed if the treatment system is not performing consistently.)*

Effluent concentration is consistently monitored. Plant performance is consistent

c) Are monitoring points properly located to determine if the individual unit processes, as well as the system as a whole, are meeting objectives? *(Monitoring should be performed between unit processes. Physical parameters {e.g., flow rates, pressures, temperatures} should be monitored in addition to chemical concentrations.)*

Each stage of process has monitoring points. In ~~at~~ initial commissioning and start up, the efficiency and performance of each process was monitored. This was not carried out after the first six months as the Treatment Plant has been performing very well and the effluent compliant with the permit.

7) Typical Performance Problems

a) Are either the influent flow rates or contaminant concentrations substantially lower than when the treatment system was designed? What is the minimum flow rate at which the system can operate and still meet objectives? Which, if any, unit processes will not function effectively at a reduced flow?

~~Unsure~~ As process calculations have been archived, we cannot answer this question.

b) If the current inflow rate is substantially less than that needed for efficient operation, consider recirculating a portion of the treated water. However, if a large portion of the treated water must be recirculated to keep the treatment system operating and the influent flow rate is not expected to increase, then modifying the treatment system to operate at a lower flow rate should be pursued. *(Recirculation should be viewed as a temporary measure and used to allow treatment*

to proceed while plans are being made to modify the treatment plant.)

Influent volume is consistent

c) If the treatment system is located outside, are there provisions to drain the water lines and the sump(s) when the system is shut down? Inspect the system to verify there is adequate insulation and / or heat tracing to prevent rupture of lines due to freezing.

N/A

8) Alternatives for Possible Cost Savings.

The types of contaminants or their concentrations in the influent may have changed to the extent that other alternatives are more cost effective.

a) State based on data whether the treatment operation is still necessary or whether influent concentrations have decreased to the point that the operation can be terminated?

Plant operation is still essential as metal, semi-volatile and volatile ~~concent~~ compound concentrations are still

b) Are more cost effective treatment alternatives available to meet the present treatment requirements? Any modifications should be economically justified based on present worth analysis compared to the operating cost of the current system.

Current system is a robust design that treat a wide range of leachate ~~constit~~ concentrations. There is no current alternative

c) Can the degree of treatment be reduced due to changed conditions? Are there any unit processes that are no longer necessary as components of the treatment train, and which can be by-passed? *(The objectives of the treatment system should be re-assessed in response to changed conditions, such as changes in: influent characteristics, discharge requirements, POTW acceptance criteria, etc.)*

All process units are still essential

d) If there are substantial differences in the concentrations of contaminants among the various water sources being treated, consider segregating the water from one or more sources for separate treatment. Consider separating individual wells for separate treatment.

Not practical. Will consider sampling Op Unit One and Op Unit Two ~~as~~ ~~the~~ an annual basis

e) If landfill leachate is being treated, is recirculation of untreated leachate back into the landfill an alternative to the above-ground treatment system (i.e., using the subsurface as a bioreactor)?

Recirculation is only applicable if the treatment plant needs to be taken out of commission or temporarily shut-down for

f) If biodegradable compounds are being treated using a vapor-phase treatment system, is injection of the vapor stream into an engineered subsurface biofilter an alternative to the above-ground treatment system (i.e., use the subsurface as a bioreactor)?

Not considered as feasible or necessary at this stage.

g) Are there analytical field methods available that could reduce costs, and still meet data quality requirements (e.g., commercial field analysis kits for COD, lead, TPH, etc.?

Laboratory analysis should still be required on a portion of the samples.

Law will be obtaining quotations to determine the best value for money for analysis, yet

h) Suggestions from the Operations Staff for streamlining the operation (e.g., changes in waste management practices, modifications to the above-ground treatment system).

9) Supplemental Notes and Data

There are 0 pages of supplemental notes and data attached to this checklist.

The Corps of Engineers needs to refer to :

- permit (already issued)
- Drawings PI 1-5
- Treatment Plant Operating Manual (already issued)

Additional Checklist Items – 5 Year Site Visit/Inspection

Background

The following information will be used to describe the fundamental aspects of the site characteristics so that the performance of the remedy can be easily compared with the site conditions the remedy was intended to address.

Background Checklist

Physical Characteristics *Present the site's location and characteristics, including:*

- area of site, relation to parcel(s), extent and location of sources
- whether site contains or is near populated areas
- whether site contains or is near environmentally sensitive areas

Refer to Annual Reports and other reports prepared for EPA

Land and Resource Use *Discuss:*

- former, current and projected land uses for the site, including the land use prior to any removal actions
  and immediately prior to cleanup
- current and projected land uses for the surrounding area
- human use of resources (such as groundwater or surface water as a drinking water supply) and any
  other current uses of the site not already covered

Ditto.

2. Remedial Actions

Discuss initial plans, implementation history, and current status of the remedy. Explain events identified in the chronology, and generally include discussions of remedy selection, remedy implementation, and system operations/O&M. Present – accurately, adequately, and concisely – relevant site activities from the signing of the ROD to the present. Be sure to delineate all remedial measures. For instance, include monitoring, fencing, and institutional controls. Discuss any changes to or problems with remedial components.

Remedial Actions Checklist

Remedy Implementation *Discuss the history of and plans for implementation of the remedy. Discuss enforcement actions if applicable.*

- dates when remedial designs were started and completed
- difficulties or changes that occurred during remedial design
- dates when remedial actions were started and completed.

Refer to other checklists

Remedial Actions Checklist

- the performance of each remedial action since implementation
- enforcement agreements, and parties involved in these agreements
- CERCLA removal actions or non-CERCLA removals/responses since the ROD

System Operations/O&M *Describe system operations/O&M requirements, activities to date, any problems that have arisen, and costs:*

- system operations/O&M requirements as noted in the system operations/O&M plan, system operations/O&M manual, enforcement documents, and monitoring plans system operations/O&M activities to date
- problems in the implementation of system operations/O&M

- originally estimated annual O&M costs
- actual annual O&M costs over the review period
- reasons for any unanticipated or unusually high O&M costs

Operational Problems

The following information regarding the status of O&M at the site will allow the review team to assess the progress of the O&M implementation, its effectiveness, and any operational problems.

Interview Information Sought

O&M Manager	–	O&M status of the remedy, compliance with permit and reporting requirements, and complaints filed
	–	effectiveness of the O&M Plan
	–	information about any potential causes for concern about the remedy
O&M Staff	–	effectiveness of the O&M Manual
	–	information about any potential causes for concern about the remedy

1. What is your impression of the project? (general sentiment) Op Unit Two is operating well especially since completion of drainage improvements.
2. Is there a continuous onsite O&M presence? If so, please describe staff and activities. If there is not a continuous onsite presence, describe staff and frequency of site inspections and activities. O&M staff work ~~for Monday~~ 3 days per week and are on standby for emergencies.
3. Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts. O&M changes have focussed on ~~being~~ having a preventative maintenance approach
4. Have there been unexpected O&M difficulties or costs at the site since start-up or in the last five years? If so, please give details. Costs have been reducing on an annual basis since 1999.
5. Have there been opportunities to optimize the operation, maintenance, or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency. Preventative maintenance, procurement of cheaper bulk chemicals have reduced costs. Law is to purchase mowing equipment to reduce lifetime costs.
6. Do you have any comments, suggestions, or recommendations regarding the project? Remediation has been effective.

Actions Taken Since Commissioning

Provide a brief but concise write-up listing and discussing improvements made, problems encountered and the corrective actions taken, modifications/additions to the design of the LF cap(s), leachate collection and transmission, leachate treatment and disposal system since commissioning of the remedy. Include information on the deficiency/improvement, reason, action taken, responsible party, and date of action.

- Minor changes in operating procedures ~~such as~~ are constantly reviewed to enhance plant performance.
- Focus has been given in 2000 and 2001 to meeting O&M Plan requirements but also ensuring that cost savings are made ~~where~~ wherever possible.
- The current philosophy of managing 2 Op Unit One and Op Unit Two is to optimize the O&M and thereby ~~look at~~ reduce the lifetime cost.

Present Worth Analysis

Labor and Engineering Support [2]	Contract Administration and Project Management [2]	2001 Total	2000 Total	Annual Variance	Discount Factor	Net Present Worth	Discount Factor	Net Present Worth	Discount Factor	Net Present Worth	Discount Factor	Net Present Worth
238,906	31,739	411,697	411,697	0	1.000	411,697	1.000	411,697	1.000	411,697	1.000	411,697
225,260	31,159	366,930	366,930	0	0.943	346,161	0.935	342,925	0.926	339,750	0.909	333,573
230,000	32,000	391,200	425,000	-33,800	0.890	348,167	0.873	341,689	0.857	335,391	0.826	323,306
230,000	32,000	350,120	425,000	-74,880	0.840	293,968	0.816	285,802	0.794	277,937	0.751	263,050
230,000	32,000	340,120	425,000	-84,880	0.792	269,407	0.763	259,476	0.735	249,998	0.683	232,307
230,000	32,000	340,120	425,000	-84,880	0.747	254,157	0.713	242,501	0.681	231,480	0.621	211,188
230,000	32,000	350,120	425,000	-74,880	0.705	246,821	0.666	233,300	0.630	220,635	0.564	197,634
230,000	32,000	340,120	425,000	-84,880	0.665	226,199	0.623	211,810	0.583	198,457	0.513	174,535
230,000	32,000	340,120	425,000	-84,880	0.627	213,395	0.582	197,953	0.540	183,756	0.467	158,668
230,000	32,000	350,120	425,000	-74,880	0.592	207,235	0.544	190,442	0.500	175,147	0.424	148,485
230,000	32,000	340,120	425,000	-84,880	0.558	189,921	0.508	172,900	0.463	157,541	0.386	131,131
230,000	32,000	340,120	425,000	-84,880	0.527	179,171	0.475	161,589	0.429	145,872	0.350	119,210
230,000	32,000	350,120	425,000	-74,880	0.497	173,999	0.444	155,457	0.397	139,037	0.319	111,559
230,000	32,000	340,120	425,000	-84,880	0.469	159,462	0.415	141,138	0.368	125,061	0.290	98,521
230,000	32,000	340,120	425,000	-84,880	0.442	150,435	0.388	131,904	0.340	115,798	0.263	89,564
230,000	32,000	350,120	425,000	-74,880	0.417	146,093	0.362	126,900	0.315	110,372	0.239	83,816
230,000	32,000	340,120	425,000	-84,880	0.394	133,887	0.339	115,210	0.292	99,278	0.218	74,020
230,000	32,000	340,120	425,000	-84,880	0.371	126,308	0.317	107,673	0.270	91,924	0.198	67,291
230,000	32,000	366,820	425,000	-58,180	0.350	128,513	0.296	108,529	0.250	91,796	0.180	65,976
230,000	32,000	340,120	425,000	-84,880	0.331	112,414	0.277	94,046	0.232	78,810	0.164	55,612
230,000	32,000	340,120	425,000	-84,880	0.312	106,051	0.258	87,893	0.215	72,972	0.149	50,557
230,000	32,000	350,120	425,000	-74,880	0.294	102,990	0.242	84,559	0.199	69,553	0.135	47,312
230,000	32,000	340,120	425,000	-84,880	0.278	94,385	0.226	76,770	0.184	62,562	0.123	41,782
230,000	32,000	340,120	425,000	-84,880	0.262	89,042	0.211	71,747	0.170	57,928	0.112	37,984
230,000	32,000	350,120	425,000	-74,880	0.247	86,472	0.197	69,025	0.158	55,214	0.102	35,546
230,000	32,000	340,120	425,000	-84,880	0.233	79,247	0.184	62,667	0.146	49,664	0.092	31,392
230,000	32,000	340,120	425,000	-84,880	0.220	74,762	0.172	58,567	0.135	45,985	0.084	28,538
230,000	32,000	350,120	425,000	-74,880	0.207	72,604	0.161	56,345	0.125	43,830	0.076	26,706
230,000	32,000	340,120	425,000	-84,880	0.196	66,538	0.150	51,155	0.116	39,425	0.069	23,585
230,000	32,000	340,120	425,000	-84,880	0.185	62,771	0.141	47,808	0.107	36,504	0.063	21,441
230,000	32,000	350,120	425,000	-74,880	0.174	60,959	0.131	45,994	0.099	34,794	0.057	20,065
$7,134,166	$ 990,898	$ 10,809,887	$ 13,103,627	$ (2,293,740)	6%	$5,213,232	7%	$4,745,471	8%	$4,348,168	10%	$ 3,716,051
$7,134,166	$ 990,898	$ 13,103,627				$5,855,630		$5,262,868		$4,761,562		$ 3,968,495
$ -	$ -	$ (2,293,740)				$ (642,397)		$ (517,397)		$ (413,393)		$ (252,445)

ɔnd half of year. Year 2002 through Year 2029 are projected costs.

very 3 years

can be used to make minor erosion repairs.

SMITH'S FARM OPERABLE UNITS ONE AND TWO

Alternate Operation and Maintenance Costs for Grass Mowing

Year *	Subcontracted Mowing Services	Purchase and Operation of Mowing Equipment	Variance	Discount Factor	Variance Present Worth	Discount Factor	Variance Present Worth	Discount Factor	Variance Present Worth	Discount Factor	Variance Present Worth
1999	603	603	0	1.000	-	1.000	-	1.000	-	1.000	-
2000	4,300	4,300	0	0.943	-	0.935	-	0.926	-	0.909	-
2001	12,000	33,800	-21,800	0.890	(19,402)	0.873	(19,041)	0.857	(18,690)	0.826	(18,017)
2002	12,000	800	11,200	0.840	9,404	0.816	9,143	0.794	8,891	0.751	8,415
2003	12,000	800	11,200	0.792	8,871	0.763	8,544	0.735	8,232	0.683	7,650
2004	12,000	800	11,200	0.747	8,369	0.713	7,985	0.681	7,623	0.621	6,954
2005	12,000	800	11,200	0.705	7,896	0.666	7,463	0.630	7,058	0.564	6,322
2006	12,000	800	11,200	0.665	7,449	0.623	6,975	0.583	6,535	0.513	5,747
2007	12,000	800	11,200	0.627	7,027	0.582	6,519	0.540	6,051	0.467	5,225
2008	12,000	800	11,200	0.592	6,629	0.544	6,092	0.500	5,603	0.424	4,750
2009	12,000	800	11,200	0.558	6,254	0.508	5,694	0.463	5,188	0.386	4,318
2010	12,000	800	11,200	0.527	5,900	0.475	5,321	0.429	4,803	0.350	3,926
2011	12,000	800	11,200	0.497	5,566	0.444	4,973	0.397	4,448	0.319	3,569
2012	12,000	800	11,200	0.469	5,251	0.415	4,648	0.368	4,118	0.290	3,244
2013	12,000	800	11,200	0.442	4,954	0.388	4,344	0.340	3,813	0.263	2,949
2014	12,000	800	11,200	0.417	4,673	0.362	4,059	0.315	3,531	0.239	2,681
2015	12,000	800	11,200	0.394	4,409	0.339	3,794	0.292	3,269	0.218	2,437
2016	12,000	800	11,200	0.371	4,159	0.317	3,546	0.270	3,027	0.198	2,216
2017	12,000	17,500	-5,500	0.350	(1,927)	0.296	(1,627)	0.250	(1,376)	0.180	(989)
2018	12,000	800	11,200	0.331	3,702	0.277	3,097	0.232	2,595	0.164	1,831
2019	12,000	800	11,200	0.312	3,492	0.258	2,894	0.215	2,403	0.149	1,665
2020	12,000	800	11,200	0.294	3,295	0.242	2,705	0.199	2,225	0.135	1,513
2021	12,000	800	11,200	0.278	3,108	0.226	2,528	0.184	2,060	0.123	1,376
2022	12,000	800	11,200	0.262	2,932	0.211	2,363	0.170	1,908	0.112	1,251
2023	12,000	800	11,200	0.247	2,766	0.197	2,208	0.158	1,766	0.102	1,137
2024	12,000	800	11,200	0.233	2,610	0.184	2,064	0.146	1,635	0.092	1,034
2025	12,000	800	11,200	0.220	2,462	0.172	1,929	0.135	1,514	0.084	940
2026	12,000	800	11,200	0.207	2,323	0.161	1,802	0.125	1,402	0.076	854
2027	12,000	800	11,200	0.196	2,191	0.150	1,685	0.116	1,298	0.069	777
2028	12,000	800	11,200	0.185	2,067	0.141	1,574	0.107	1,202	0.063	706
2029	12,000	800	11,200	0.174	1,950	0.131	1,471	0.099	1,113	0.057	642
Totals	352,903	$ 77,803	$ 275,100	6%	$ 108,379	7%	$ 94,750	8%	$ 83,245	10%	$ 65,123

* Year 1999 and Year 2000 are sunk costs. Year 2001 include costs incurred through mid-year and projected costs for second half of year. Year 2002 through Year 2029 are projected costs.

Grass Mowing

Capital Cost (Year 2001)

Item	Description		Total
1	Butler Building (24x24x12)	$	6,400
2	Building Base and Site Grading	$	1,000
3	Tractor (New Holland TC 40D w/ loader, pallet forks, hydro trans, etc.)	$	23,700
4	Delivery Charge	$	50
4	Push Mower	$	150
5	Weed Eater (2)	$	400
6	6' Rotary Cutter	$	1,300
	Total	**$**	**33,000**

Annual Maintenance Cost (Year 2001 through Year 2029)

Item	Description		Total
1	Oil and Fuel	$	250
3	Blade Sharpening and Replacement	$	25
4	Transmission, Brake, Filters, and Hydraulic Fluid Maintenance	$	100
5	Repairs (1% of initial cost) [rounded $100]	$	200
6	Weed Eater (replaced every 5 years)	$	40
7	Miscellaneous Supplies	$	85
8	Tires (Pro-rated $1,000 in 10 years)	$	100
	Total	**$**	**800**

Capital Cost (Year 2017)

Item	Description		Total
1	Tractor (New Holland TC 40D w/ loader, pallet forks, hydro trans, etc.)	$	23,700
2	6' Rotary Cutter	$	1,300
1	Tractor Salvage Value	$	(7,900)
2	6' Rotary Cutter Salvage Value	$	(400)
	Total	**$**	**16,700**

Assume useful-life of tractor and rotary cutter at 15 years with a 33.3% salvage value.

Carbon Changeout

Item	Description	Unit	Quantity	Unit Cost	Total
1	Carbonair (Haz)	LS	1	$ 9,067	$ 9,067
2	Misc Cost	LS	1	$ 933	$ 933
Total					**$ 10,000**

Sludge Transportation and Disposal

Year 2001 *

Item	Description	Unit	Quantity	Unit Cost	Total
1	55 - gal Drum Disposal (Haz)	Ea	24	$ 600	$ 14,400
2	Drum Pickup	Qrtly	4	300	$ 1,200
					$ 15,600

Years 2002 through 2029

Item	Description	Unit	Quantity	Unit Cost	Total
1	55 - gal Drum Disposal (Non Haz)	Ea	24	$ 55	$ 1,320
2	Drum Pickup	Qrtly	4	300	$ 1,200
					$ 2,520

* Assumed that residual toluene will decrease in concentration by the end of Year 2001 below TCLP level.

Annual Laboratory Analytical Costs

Year 2001 through Year 2003

Item	Description	Unit	Quantity	Unit Cost*	Total**
1	TCLP (NVE & ZHSE) for Sludge	Ea	12	$ 1,109	$ 13,400
2	Influent Grab Sample	Ea	2	$ 1,063	$ 2,200
3	Effluent Grab Sample	Ea	4	$ 1,063	$ 4,300
4	TCLP (NVE & ZHSE) for Carbon #1	Ea	8	$ 970	$ 7,800
5	Shipping Fee	Mo.	12	$ 45	$ 600
6	Ground Water Monitoring	Event	2	$ 7,200	$ 14,500
	Total				**$ 42,800**

Year 2004 through Year 2029

Item	Description	Unit	Quantity	Unit Cost*	Total**
1	TCLP (NVE & ZHSE) for Sludge	Ea	12	$ 1,109	$ 13,400
2	Influent Grab Sample	Ea	2	$ 1,063	$ 2,200
3	Effluent Grab Sample	Ea	4	$ 1,063	$ 4,300
4	TCLP (NVE & ZHSE) for Carbon #1	Ea	8	$ 970	$ 7,800
5	Shipping Fee	Mo.	12	$ 45	$ 600
6	Ground Water Monitoring	Event	2	$ 7,200	$ 14,500
	Total				**$ 42,800**

* Based on current Lancaster Laboratories charges.

** Totals rounded up to nearest $100.

Miscellaneous Operating Costs

Part Name	Replacement Cost	Usage (Yrs)	Maintenance Cost	Maintenance Frequency (1/Yr)	Annual Cost *
Bldg Sump	$ 750	7.5	$ -	-	$ 100
RAS Sump Pump	$ 750	7.5	$ -	-	$ 100
WAS Sump Pump	$ 750	7.5	$ -	-	$ 100
Metal Feed Pump	$ 750	7.5	$ -	-	$ 100
Blower Motors	$ 1,500	7.5	$ 100	0.50	$ 250
Stiring Motors	$ 250	7.5	$ -	-	$ 30
Polymer Stir Motor	$ 500	7.5	$ 50	0.50	$ 90
Air Stir Feed Pump	$ 750	7.5	$ -	-	$ 100
Air Sitr Sump Pump	$ 650	7.5	$ -	-	$ 90
Bag Filters (2)	$ 100	12.5	$ 10	17.33	$ 180
Miscellaneous Equipment	$ 120	1	$ 100	1.00	$ 220
Monitoring Wells (22)	$ 5,500	12.5	$ 1,100	2.00	$ 2,640
Total Annual Miscellaneous Operating Cost					**$ 4,000**

* Rounded to nearest $10.

Appendix D

Photographs

Photo 1 – Main Gate

Photo 2 – Typical Lined and Paved Letdown Channel (OU2 Landfill Cap)

Photo 3 – Leachate Collection Lift Station

Photo 4 – Lift Station to Leachate Treatment Plant

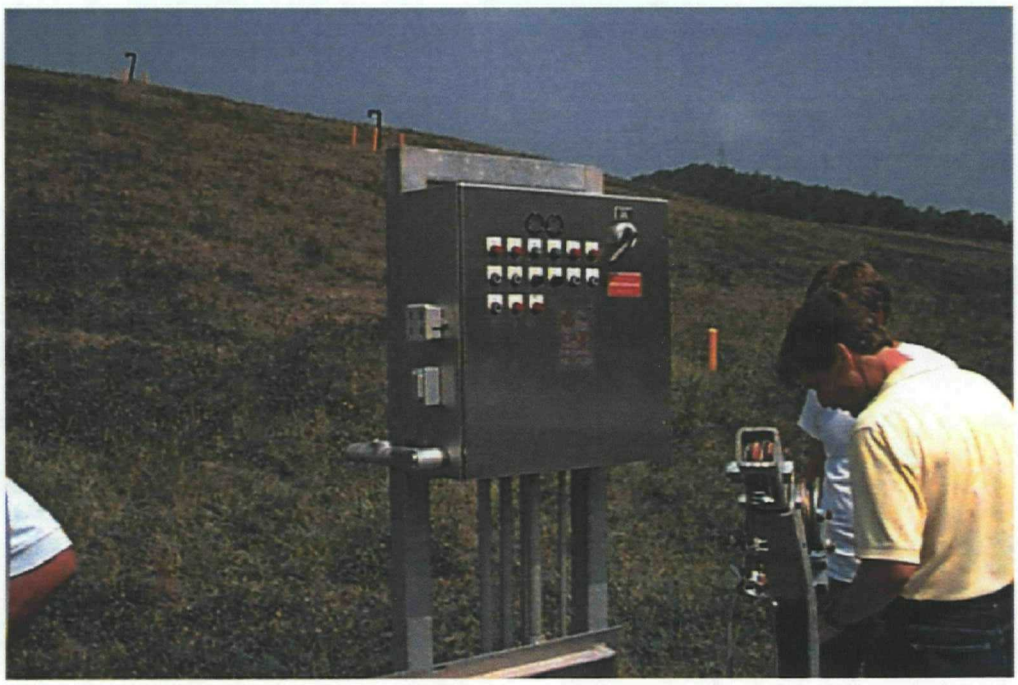


Photo 5 – Control Panel, Lift Station

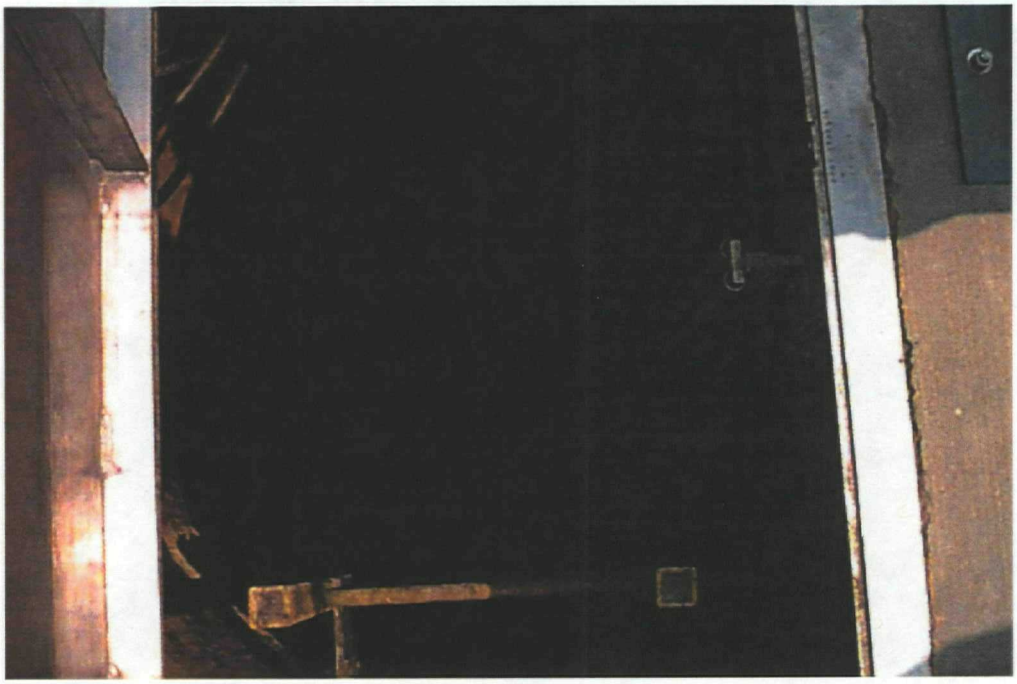


Photo 6 – Primary Lift Station

Photo 7 – Lift Station Wet well

Photo 8 – Surface Drainage Improvements, Toe of Slope, OU2 Landfill

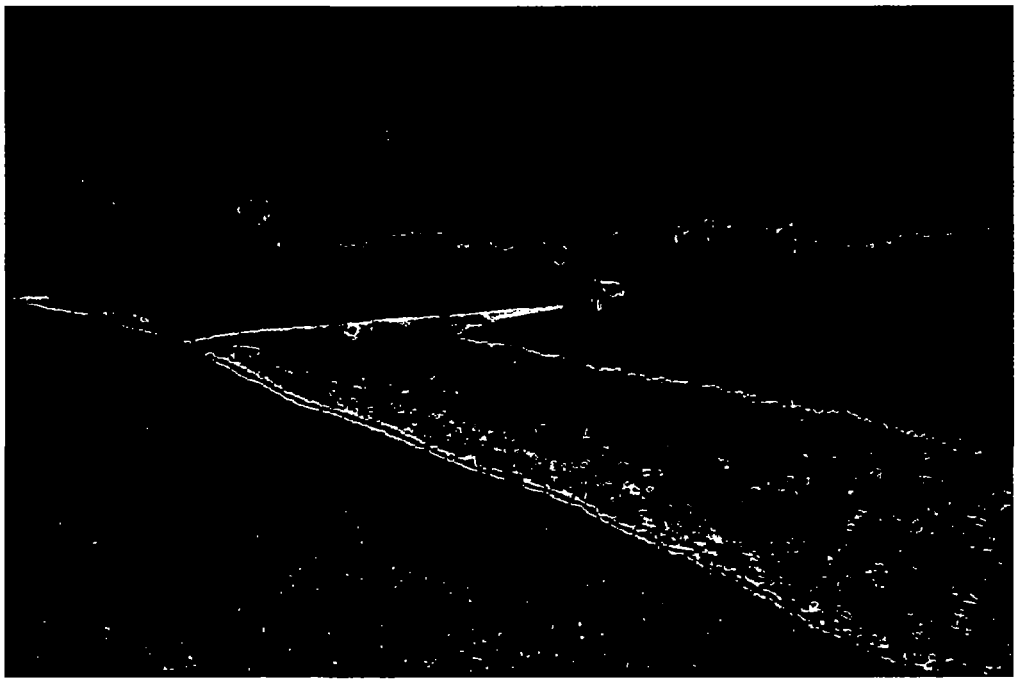


Photo 9 – Drainage and Access Road, Improvements West End OU2 Landfill

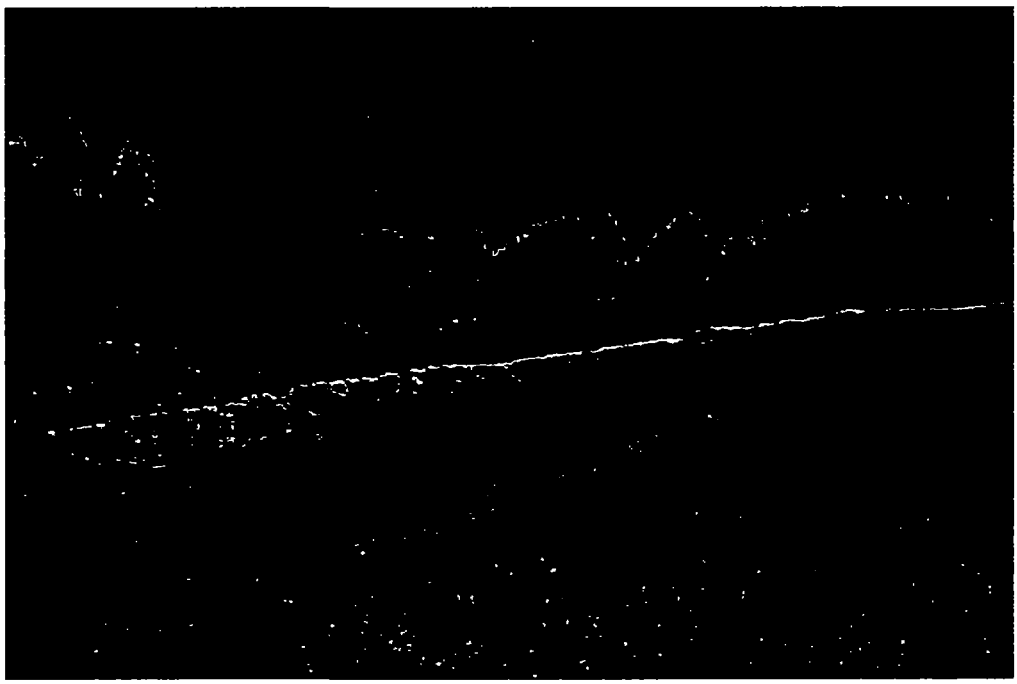


Photo 10 – Drainage and Access Road, Improvements West End OU2 Landfill

Photo 11 – OU2 West Access Road and Surface Drainage Improvements

Photo 12 – UO2 West Access Road and Surface Drainage Improvements

Photo 13 – OU2 Landfill, East View

Photo 14 – OU2 Landfill, East View, Passive Gas Vent

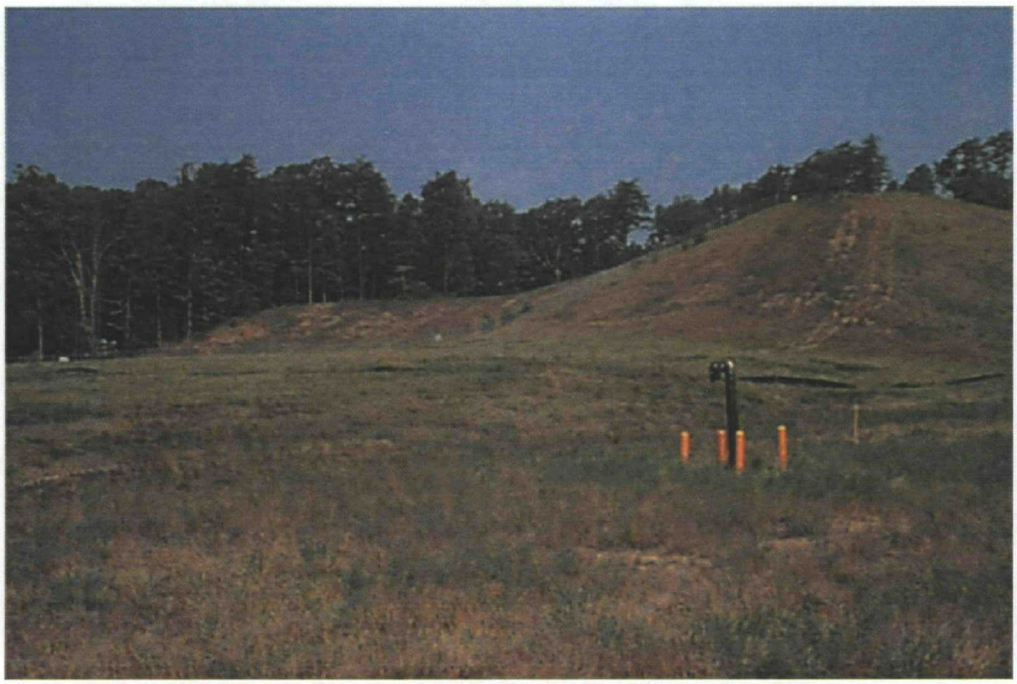


Photo 15 – OU2 Landfill, North View

Photo 16 – OU2 Landfill, North View, Stressed Vegetation

Photo 17 – OU2 Landfill, Letdown Channel Improvements

Photo 18 – Landfill South Downslope-Letdown Channel, Interceptor Bench

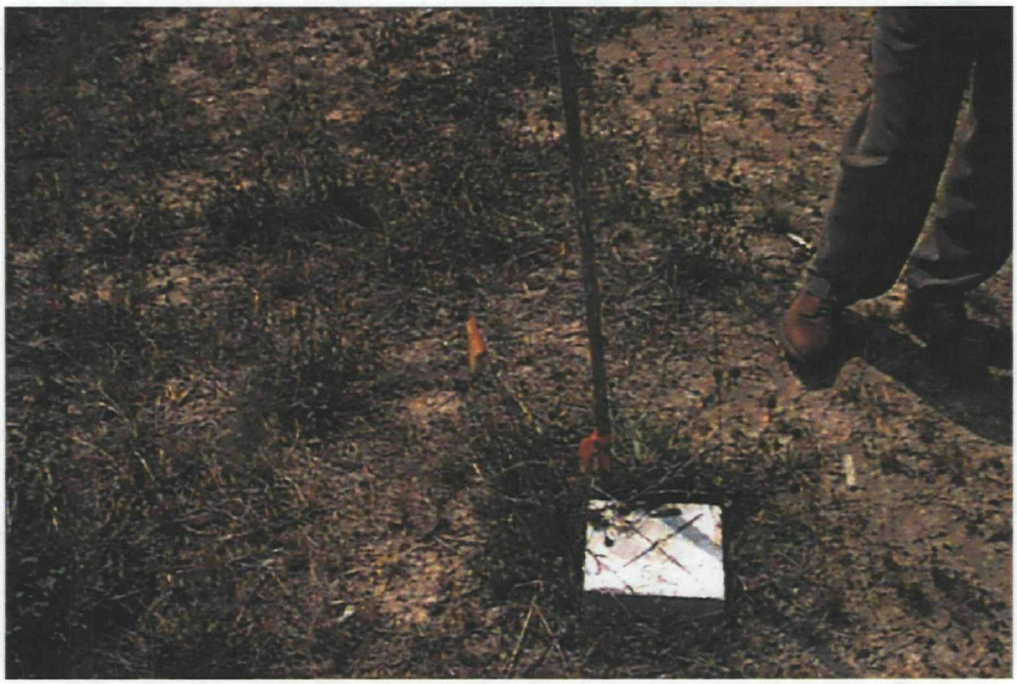


Photo 19 – OU2 Landfill, Typical Survey Monument

Photo 20 – OU2 Surface Drainage Improvements

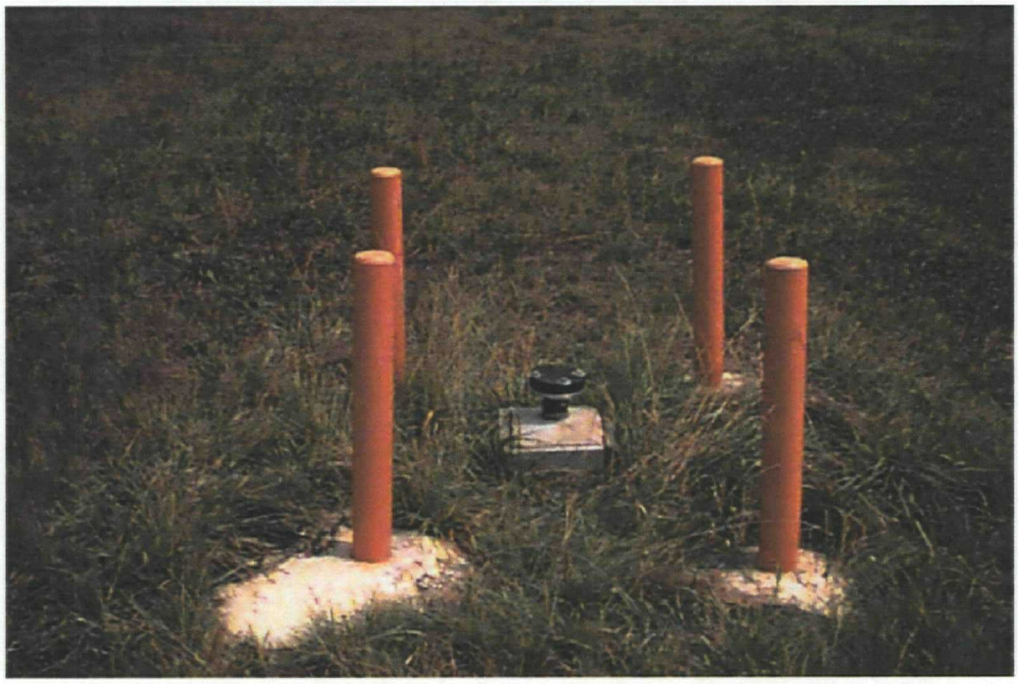


Photo 21 – Typical Capped Well Location

Photo 22 – Typical Extraction Well

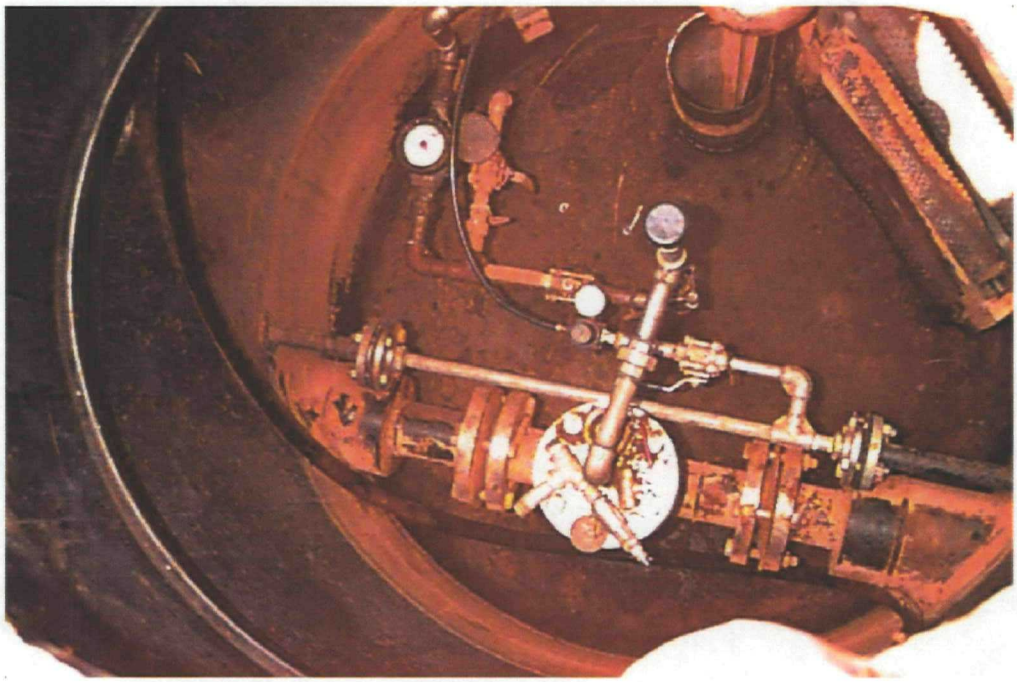


Photo 23 – Typical Extraction Well

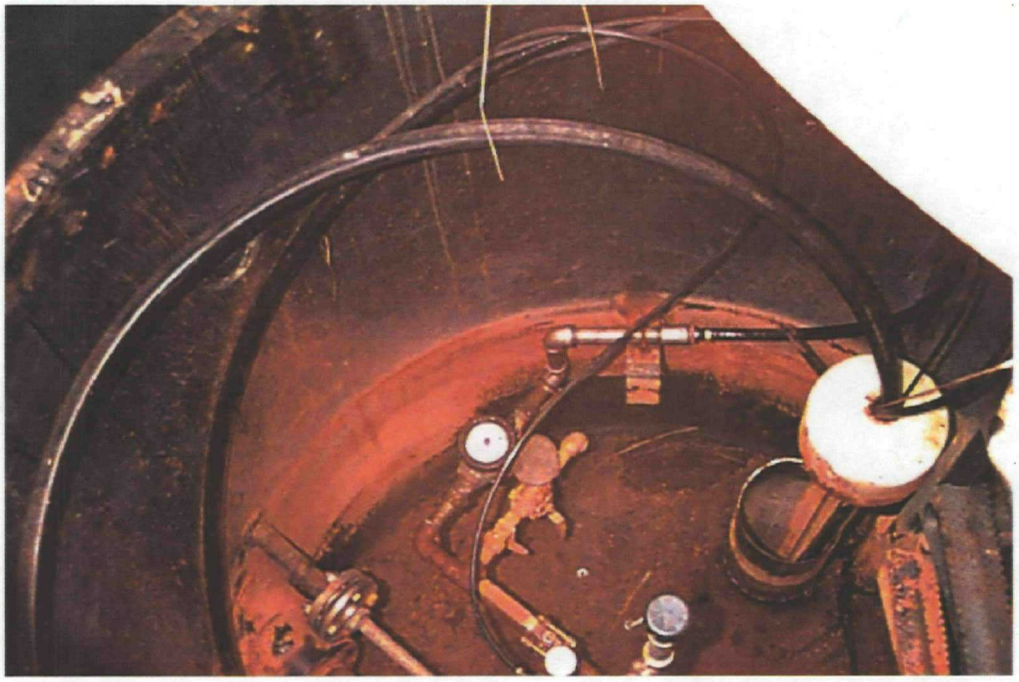


Photo 24 – Typical Extraction Well

Photo 25 – OU2 Landfill, Downslope

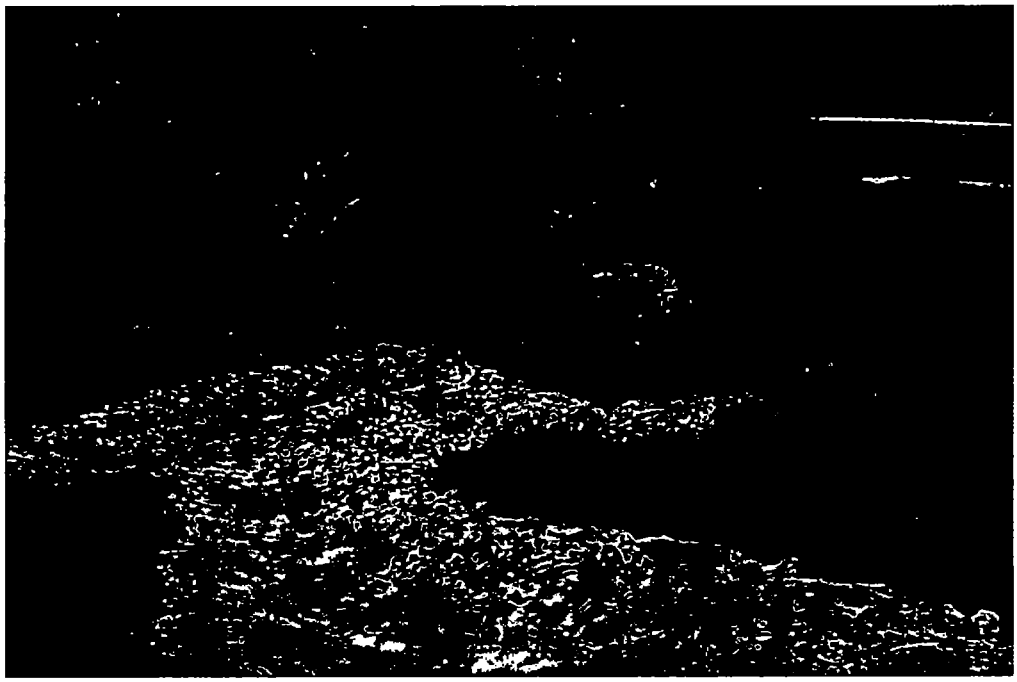


Photo 26 – OU2 Landfill, Drainage Improvements

Photo 27 –

Photo 28 – Typical Monitoring Well Installation, MW-29

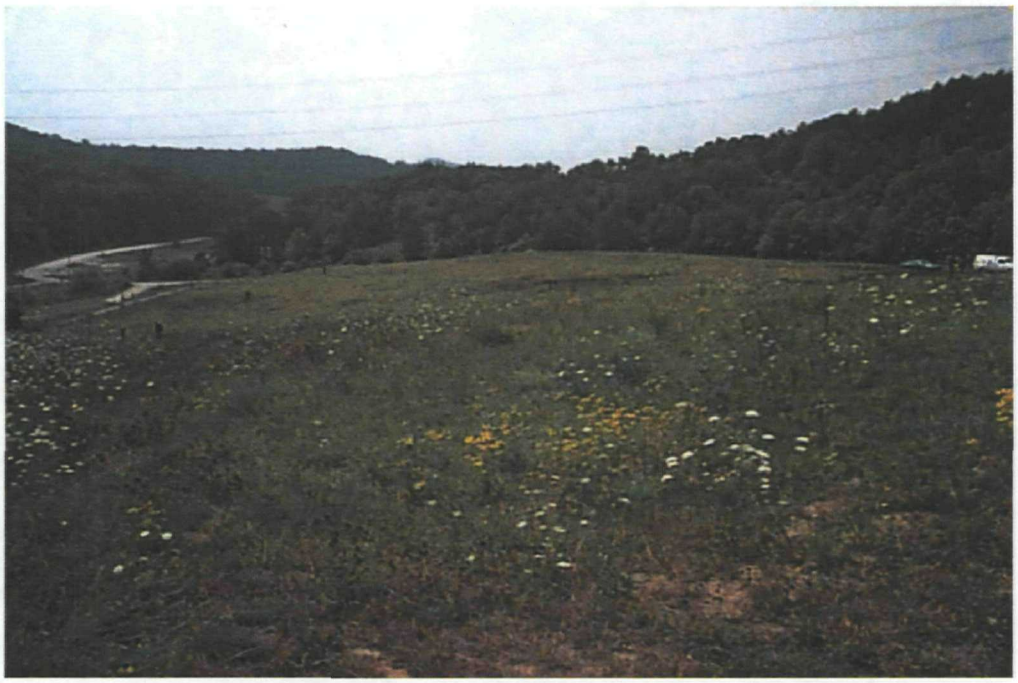


Photo 29 – OU1 Landfill, Downslope View West

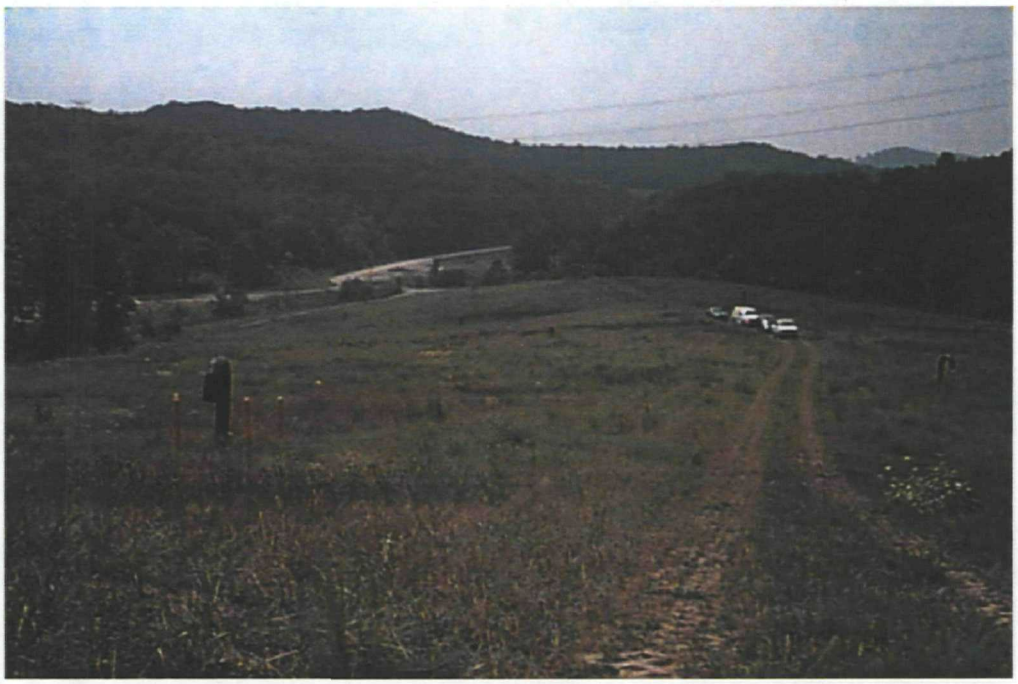


Photo 30 – OU1 Landfill, Downslope View West, Gas Vent

Photo 31 – OU1 Leachate Collection Pump Station

Photo 32 – OU2 Landfill, Leachate Treatment Discharge Pipe, Gabion Drainage Protection, and Letdown Channel

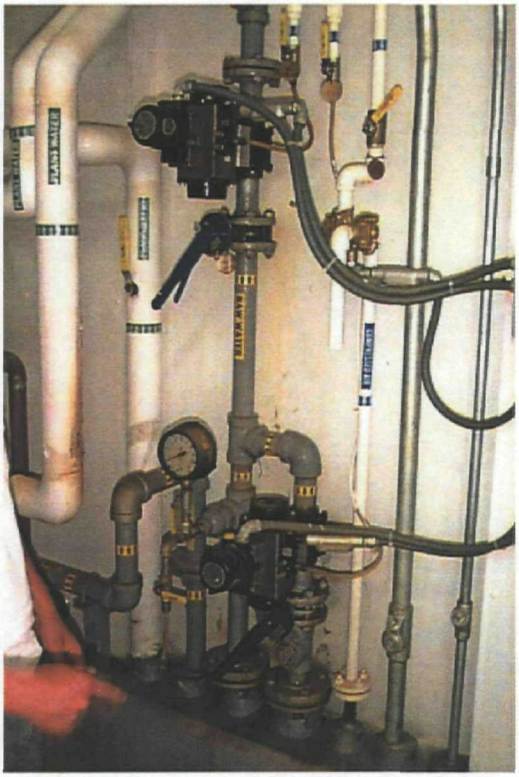


Photo 33 – Leachate Treatment Plant, Influent Metering Point

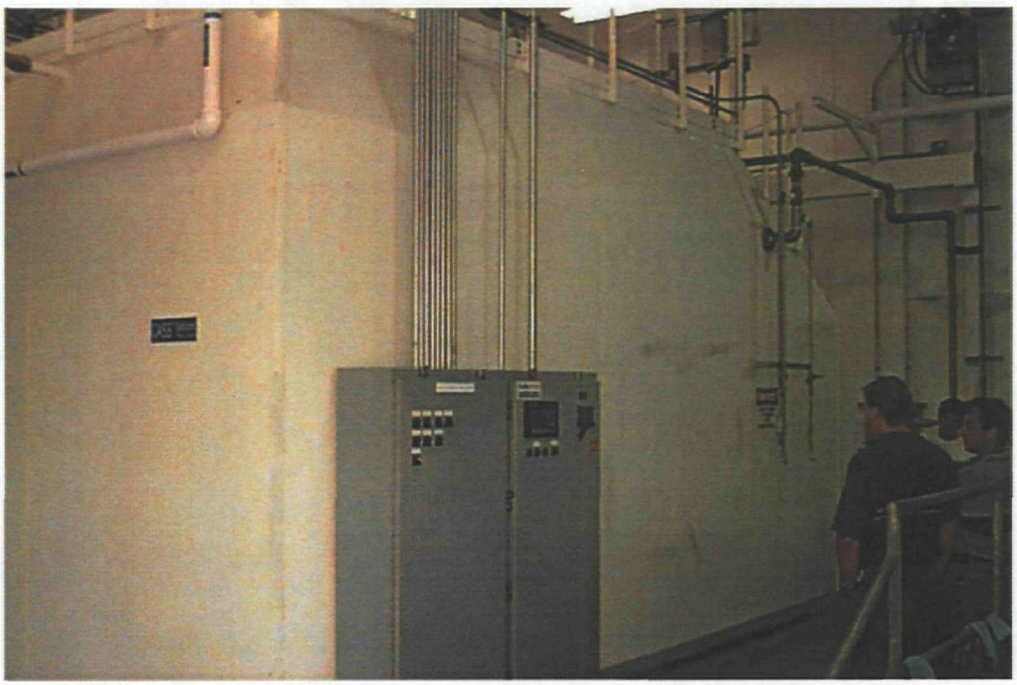


Photo 34 – Package Sequencing Batch Reactor (SBR)

Photo 35 – Sludge Thickening Tank (T-8-1)

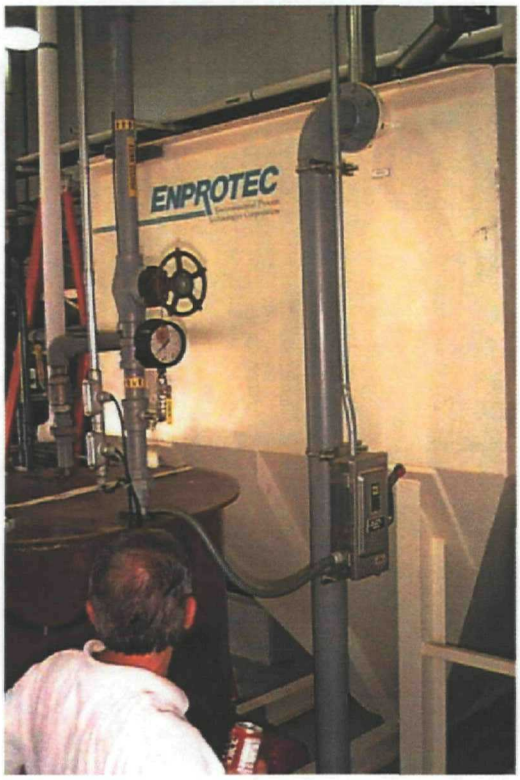


Photo 36 – Package Metals Removal Unit (MRU)

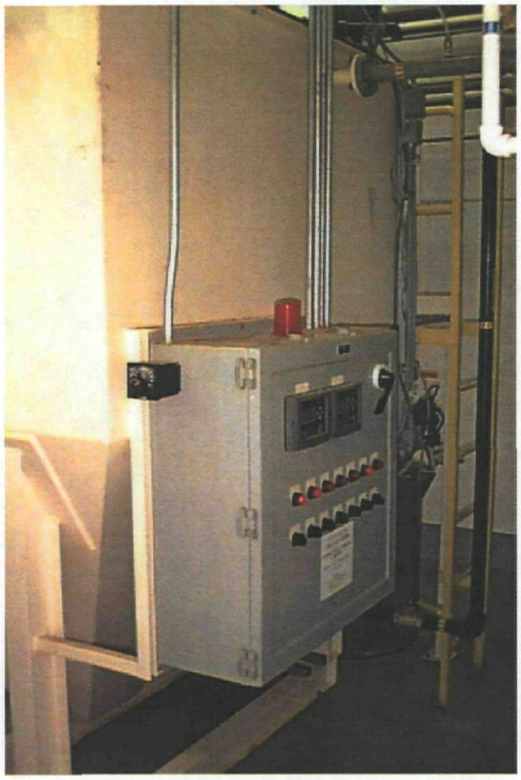


Photo 37 – Metals Removal Unit Control Panel

Photo 38 –

Photo 39 – Anionic Polymer Tank

Photo 40 –Package Low Profile Air Stripper (R-4-1)

Photo 41 – Granular Activated Carbon Vessels - Polishing

Photo 42 – Sodium Hydroxide and Sulfuric Acid Storage Totes

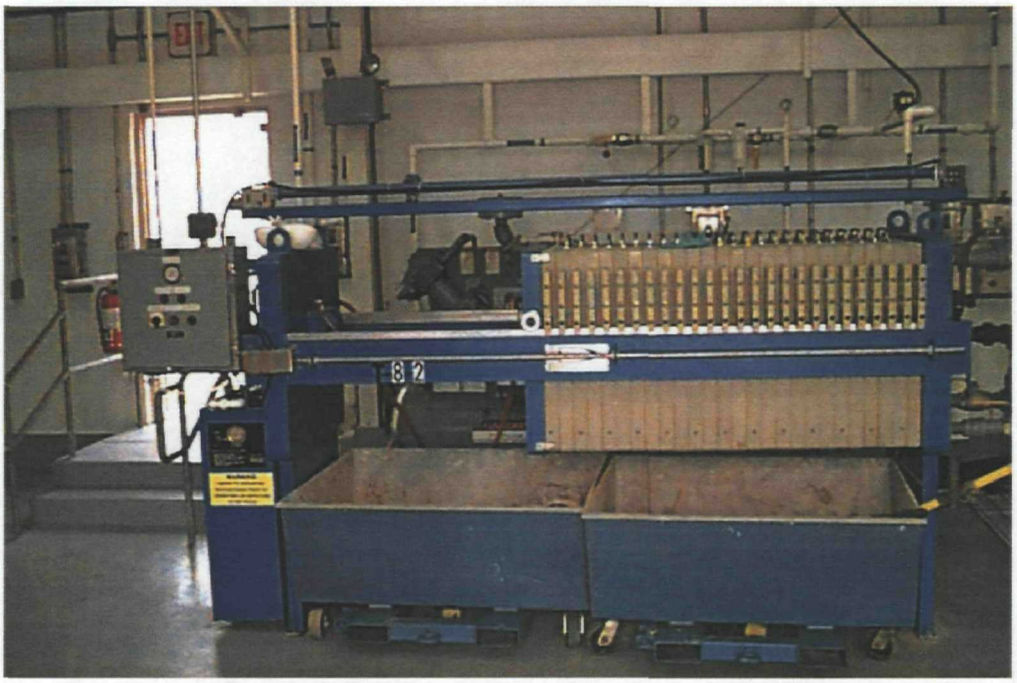


Photo 43 –Package Filter Press – Sludge Dewatering

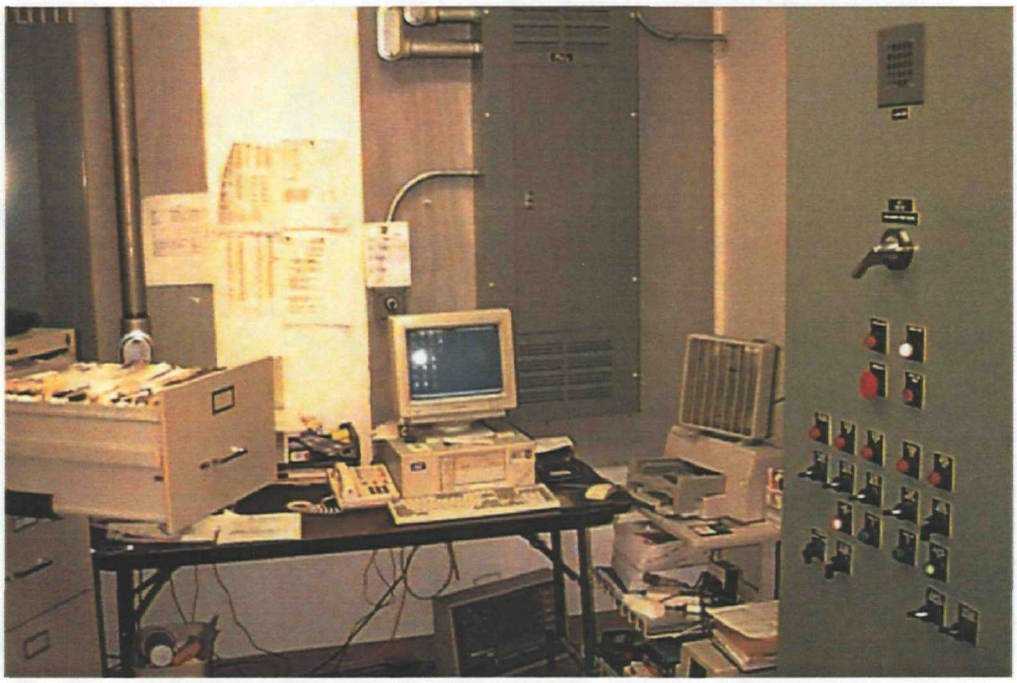


Photo 44 –Office, Leachate Treatment Building, and Control Panel

Photo 45 –Exterior Leachate Treatment Building

Appendix E

US Army Corps
of Engineers
Louisville District

Appendix E

Quarterly O&M Inspection Form
Quarterly O&M Inspection, July 26, 2001

QUARTERLY INSPECTION REPORT (FORM QIR)

Date _____ Report No. _____

1. Security Fence

Questions	Response	Comments and Recommendations
Is damage evident? If Yes, describe the type of damage(s), and indicate the location(s) a map attached.	Yes No	
Are warning signs missing or damaged? If Yes, describe the type of damage and indicate the location(s) on a map attached.	Yes No	
Is erosion evident under chain-link sections or around posts? If Yes, describe the type of erosion (rills, gullies, valleys, washouts), record approximate dimensions (length, width, depth) and indicate location(s) on a map attached.	Yes No	
Has failure of any fencing members occurred? If Yes, describe the failure(s) and indicate location(s) on a map attached.	Yes No	

2. Landfill Cap

Questions	Response		Comments and Recommendations
Is settlement or standing water evident? If Yes, describe the degree of settlement(s) (slight, moderate, significant), record approximate dimensions, and indicate the location(s) on a map attached.	Yes	No	
Have settlement monuments been disturbed? If Yes, describe the type of disturbance (missing, overturned, leaning, broken) and indicate disturbed monument(s) on a map attached.	Yes	No	
Is erosion evident? If Yes, describe the type of erosion (rills, gullies, valleys, washouts, slope failure), record approximate dimensions (length, width, depth) and indicate location(s) on a map attached.	Yes	No	
Is vegetation distressed or are bare areas evident? If Yes, describe the type of disorder (distressed, sparsely vegetated, bare), record approximate dimensions and indicate location(s) on a map attached.	Yes	No	

2. Landfill Cap (continued)

Questions	Response	Comments and Recommendations
Is any other damage evident? If Yes, describe the type of damage(s) and indicate the location(s) on a map attached.	Yes No	
Are obstruction(s) (brush, debris, timber leaves, sediment) interfering with the proper functioning of terraces? Outlets from terraces? Channels? Channel Outlets? If Yes, describe the type(s) of obstruction(s) and indicate the location(s) on a map attached.	Yes No	
Is sediment deposited in drainage channels to a depth greater than ¼ of the original channel depth (shown on the contract drawings)? If Yes, record approximate dimensions and indicate location(s) on a map attached.	Yes No	

3. Gas Control System

Questions	Response	Comments and Recommendations
Is damage evident? If Yes, describe the type of damage (vent/well riser cover missing, vent/well riser cracked, overturned, leaning, broken) and indicate damaged gas vent/well riser(s) on a map attached.	Yes No	
Is settlement or standing surface water evident? If Yes, describe the degree of settlement(s) (slight, moderate, significant), record approximate dimensions, and indicate the location(s) on a map attached.	Yes No	

4. Surface Water Drainage and Erosion Control System

Questions	Response	Comments and Recommendations
Is overall shape, configuration, and alignment of the drainageway as shown on the drawings? If No, describe the type of distortion (damaged, eroded, slope failure), record approximate dimensions and indicate location(s) on a map attached.	Yes No	
Is erosion evident? If Yes, describe the drainage structure inspected (channel, culvert, outfall, gabions), the type of erosion (rills, gullies, valleys, washouts, slope failure), record approximate dimensions (length, width, depth) and indicate location(s) on a map attached.	Yes No	
Is settlement or standing surface water evident? If Yes, describe the drainage structure inspected, the degree of settlement(s) (slight, moderate, significant), record approximate dimensions, and indicate the location(s) on a map attached.	Yes No	

4. Surface Water Drainage and Erosion Control System (continued)

Questions	Response		Comments and Recommendations
Are obstruction(s) (brush, debris, timber leaves, sediment) interfering with the proper functioning of drainageway or the stability of adjacent embankments? If Yes, describe the type(s) of obstruction(s) and indicate the location(s) on a map attached.	Yes	No	
Is sediment deposited in drainage channels or culverts deeper than ¼ of the original channel depth (shown on the contract drawings) or culvert diameter? If Yes, record approximate dimensions and indicate locations on a map attached.	Yes	No	
Is structural damage evident? If Yes, describe the type of damage (upheaval, cracking, undermined, overturned, fractured, broken) and indicate damaged structure(s) on a map attached.	Yes	No	
Have stones been dislodged at rip rapped drainage outlet aprons? If Yes, record approximate dimensions and indicate location(s) on a map attached.	Yes	No	

5. Leachate Collection System

Questions	Response	Comments and Recommendations
Are any Manholes leaking? If Yes, describe the magnitude of the leak (drip, steady discharge, single overflow) and indicate location(s) of leaky Manholes on an attached map.	Yes No	
Are any pipes or valves leaking? If Yes, describe the magnitude of the leak (drip, steady discharge, single overflow) and indicate location(s) of leaky Manholes on an attached map.	Yes No	
Are leachate extraction well pumps operating properly? If No, describe the malfunction and indicate the extraction well number.	Yes No	

5. Leachate Collection System (continued)

Questions	Response		Comments and Recommendations
Is damage or degradation evident at these system components?			
Leachate Extraction Well Manholes?	Yes	No	
Extraction Well Pumps and associated Piping?	Yes	No	
Leachate Junction Manhole?	Yes	No	
Leachate Lift Station and Lift Station Pump?	Yes	No	
Leachate Detection Points?	Yes	No	
Leachate Collection Pipe Cleanouts and Vents?	Yes	No	
Is Leachate Evident in any of the Leachate Detection Points? If yes, indicate which one(s).	Yes	No	

6. Infiltration Gallery

Questions	Response		Comments and Recommendations
Is standing water present? If Yes, describe.	Yes	No	
Is debris or trash present? If Yes, describe.	Yes	No	
Are strong odors present? If Yes, describe.	Yes	No	
Is the 6-inch diameter perforated HDPE at the infiltration gallery obstructed? If Yes, describe the magnitude of the obstruction (75% blocked, 50% blocked).	Yes	No	

7. Access Roads

Questions	Response	Comments and Recommendations
Is pavement distress evident? If Yes, describe (cracking, pothole(s) upheaval, failed patch), record the approximate dimensions (length, width, and depth), and indicate location(s) on an attached map.	Yes No	
Is erosion evident on shoulders embankments, or drainage ditches? If Yes, describe the type of erosion (rills, gullies, valleys, washouts, slope failure), record approximate dimensions (length, width, depth) and indicate location(s) on a map attached.	Yes No	
Are culverts damaged? If Yes, describe the culvert inspected, conditions observed (spalling, cracking, exposed reinforcement, joint separation) and indicate location(s) of impacted culvert(s) on a map attached.	Yes No	

7. **Access Roads (continued)**

Questions	Response	Comments and Recommendations
Are obstructions present in the culverts or impacting the stability of adjacent embankments? If Yes, describe the obstacle(s) (leaves, brush, debris, timber, sediment), and indicate the location(s) on a map attached.	Yes No	
Is sediment deposited in culvert(s) deeper than ¼ of the culvert diameter? If Yes, record approximate dimensions and indicate location(s) on a map attached.	Yes No	
Are obstructions present in the drainage ditches adjacent to the road shoulders? If Yes, describe the obstacle(s) (leaves, brush, debris, timber, sediment), and indicate the location(s) on a map attached.	Yes No	
Is road access to OU2 and the treatment plant safe and efficient?	Yes No	

8. General Comments or Observations

INSPECTOR

_____
Typed or Printed Name

_____
Signature

(SEAL)

_____

REVIEWED BY:

_____
Typed or Printed Name

_____
Signature

Kentucky P.E. No. _____

STORM EVENT INSPECTION REPORT FORM (FORM SE)

Date _____ Report No. _____

Surface Water Drainage System

Is erosion evident?	Yes	No	Do culverts need cleaning?	Yes	No
Is settlement evident?	Yes	No	Do ditches need cleaning?	Yes	No
Are obstacles evident?	Yes	No	Have any erosion control measures failed?	Yes	No
Are surfaces damaged?	Yes	No			

Use an attached map to show areas of concern and describe below.

INSPECTOR

_____
Typed or Printed Name

_____
Signature

(SEAL)

_____

REVIEWED BY:

_____
Typed or Printed Name

_____
Signature

Kentucky PE No. _____

QUARTERLY INSPECTION REPORT (FORM QIR)

1. Security Fence

Questions	Response		Comments and Recommendations
Is damage evident? If Yes, describe the type of damage(s), and indicate the location(s) on a map attached.	**Yes**	No	**Vandalism at North Gate. Currently being repaired.**
Are warning signs missing or damaged? If Yes, describe the type of damage and indicate the location(s) on a map attached.	Yes	**No**	
Is erosion evident under chain-link sections or around posts? If Yes, describe the type of erosion (rills, gullies, valleys, washouts), record approximate dimensions (length, width, depth) and indicate location(s) on a map attached.	Yes	**No**	

2. Area "B"

Is erosion evident? If yes, describe the type of erosion (rills, gullies, valleys, slope failure), record general measurements (depth, width, length), and indicate location(s) of erosion on a map attached.	**Yes**	No	**Erosion evident throughout Area B. Currently being repaired.**

3. RCRA Cap

Questions	Response	Comments and Recommendations
Is settlement or standing water evident? If Yes, describe the degree of settlement(s) (slight, moderate, significant), record general measurements (depth, width, length) and indicate the location(s) on a map attached.	Yes **No**	
Have settlement monuments been disturbed? If Yes, describe the type of disturbance (missing, overturned, leaning, broken, shoved, moved) and indicate disturbed monument(s) on a map attached.	Yes **No**	
Is erosion evident? If Yes, describe the type of erosion (rills, gullies, valleys, washouts, slope failure), record approximate dimensions (length, width, depth) and indicate location(s) on a map attached.	Yes **No**	
Is vegetation distressed or are bare areas evident? If Yes, describe the type of disorder (distressed, sparsely vegetated, bare), record approximate dimensions and indicate location(s) on a map attached.	Yes **No**	

3. RCRA Cap (continued)

Questions	Response		Comments and Recommendations
Is any other damage evident? If Yes, describe the type of damage(s) and indicate the location(s) on a map attached.	Yes	No	

4. Gas Collection System

Is damage evident? If Yes, describe the type of damage (vent/well riser cover missing, vent/well riser cracked, overturned, leaning, broken) and indicate damaged gas vent/well riser(s) on a map attached.	Yes	No	
Is settlement or standing surface water evident? If Yes, describe the degree of settlement(s) (slight, moderate, significant), record approximate dimensions, and indicate the location(s) on a map attached.	Yes	No	

5. Surface Water Drainage and Erosion Control System

Is overall shape, configuration, and alignment of the drainageway as shown on the drawings? If No, describe the type of distortion (damaged, eroded, slope failure), record approximate dimensions and indicate location(s) on a map attached.	Yes	No	

5. Surface Water Drainage and Erosion Control System (continued)

Questions	Response	Comments and Recommendations
Is erosion evident? If Yes, describe the drainage structure inspected (channel, culvert, outfall, gabions), the type of erosion (rills, gullies, valleys, washouts, slope failure), record approximate dimensions (length, width, depth) and indicate location(s) on a map attached.	Yes **No**	
Is settlement or standing surface water evident? If Yes, describe the drainage structure inspected, the degree of settlement(s) (slight, moderate, significant), record approximate dimensions, and indicate the location(s) on a map attached.	Yes **No**	
Are obstruction(s) (brush, debris, timber leaves, sediment) interfering with the proper functioning of drainageway or the stability of adjacent embankments? If Yes, describe the type(s) of obstruction(s) and indicate the location(s) on a map attached.	Yes **No**	
Is structural damage evident? If Yes, describe the type of damage (upheaval, cracking, undermined, overturned, fractured, broken) and indicate damaged structure(s) on a map attached.	Yes **No**	

6. Retaining Walls

Questions	Response		Comments and Recommendations
Is joint leakage evident? If yes, describe the type of leakage (dripping, flowing, streaming, gushing); record color, scent, viscosity of fluid leaking; and indicate location(s) of leakage on a map attached.	Yes	No	**Small areas evident. No fluid.**
Is surface damage evident? If yes, describe the type of damage (spalling, cracking, alligator cracking, exposed steel reinforcement, joint separation, joint faulting), record general measurements (depth, width, length, surface area), and indicate location(s) of damage on a map attached.	Yes	No	

7. Leachate Collection System

Are any manholes leaking? If Yes, describe the magnitude of the leak (dripping, flowing, streaming, gushing) single overflow) and indicate location(s) of leaky Manholes on a map attached.	Yes	No	**Annual inspection.**
Are any pipes leaking? If Yes, describe the magnitude of the leak (dripping, flowing, streaming, gushing) and indicate location(s) of leaky Manholes on a map attached.	Yes	No	**Annual inspection.**

8. Access Roads

Questions	Response		Comments and Recommendations
Is pavement distress evident? If Yes, describe (cracking, pothole(s) upheaval, failed patch), record the approximate dimensions (length, width, and depth), and indicate location(s) on an attached map.	Yes	No	**Many areas have alligator cracking. No large areas noted.**
Is erosion evident on shoulders or slopes? If Yes, describe the type of erosion (rills, gullies, valleys, washouts, slope failure), record approximate dimensions (length, width, depth) and indicate location(s) on a map attached.	Yes	No	
Are culverts damaged? If Yes, describe the culvert inspected, conditions observed (spalling, cracking, exposed reinforcement, joint separation) and indicate location(s) of impacted culvert(s) on a map attached.	Yes	No	
Are obstructions present in the culverts or impacting the stability of adjacent embankments? If Yes, describe the obstacle(s) (leaves, brush, debris, timber, sediment), and indicate the location(s) on a map attached.	Yes	No	

8. Access Roads (continued)

Questions	Response	Comments and Recommendations
Is sediment deposited in culvert(s) deeper than ¼ of the culvert diameter? If Yes, record approximate dimensions and indicate location(s) on a map attached.	Yes No	
Is erosion evident in soil ditches? If Yes, describe the ditch inspected, type of erosion (meandering, out of alignment), and indicate location(s) on a map attached.	Yes No	
Are obstructions present in the drainage ditches adjacent to the road shoulders? If Yes, describe the obstacle(s) (leaves, brush, debris, timber, sediment), and indicate the location(s) on a map attached.	Yes No	
Do soil ditches need cleaning? If Yes, describe the type of cleaning required.	Yes No	

9. Leachate Storage Tanks

Is settlement around storage area evident? If yes, rate the degree of settlement (minor, mild, major, catastrophic) record general measurements (depth, width, length) and indicate location(s) on a map attached.	Yes No	

9. Leachate Storage Tanks (continued)

Questions	Response		Comments and Recommendations
Is erosion evident? If yes, describe the type of erosion (gullies valleys, washouts), record general measurements (depth, width, length) and indicate location(s) on a map attached.	Yes	No	
Are surface drainage obstructions evident? If yes, describe the type of obstacles(s) encountered (leaves, limbs, trash, silt) and indicate location(s) of obstacles on a map attached.	Yes	No	
Is the tank leak detection system okay? If no, describe the problem(s) with the system.	Yes	No	**Annual inspection**
Is liquid present in secondary containment space?	Yes	No	**Annual inspection**
Are one or both of the Tanks leaking? If Yes, describe the type of leak(s) (dripping, flowing, streaming, gushing), record which tank is leaking, and where the leak(s) is/are taking place	Yes	No	**Annual inspection.**

9. Leachate Storage Tanks (continued)

Questions	Response	Comments and Recommendations
Are any valves leaking? If Yes, describe the type of leak(s) (dripping, flowing, streaming, gushing), record the type of valve leaking, and describe where is the system the leak is occurring.	Yes **No**	
Is damage evident? If Yes, describe the damaged component (reinforced concrete pad, manhole cover, control panel, guard post) and the type of damage encountered.	Yes **No**	

INSPECTOR

Ebbert B. Taylor
Typed or Printed Name

Ebbert B Taylor
Signature

REVIEWED BY:

Jason S. Ross, P.E.
Typed or Printed Name

Signature

Kentucky P.E. No. 20437

STATE OF KENTUCKY JASON S. ROSS 20437 LICENSED PROFESSIONAL ENGINEER

QUARTERLY INSPECTION REPORT (FORM QIR)

1. Security Fence

Questions	*Response*		*Comments and Recommendations*
Is damage evident? If Yes, describe the type of damage(s), and indicate the location(s) on a map attached.	Yes	No	**Section of fence currently being repaired.**
Are warning signs missing or damaged? If Yes, describe the type of damage and indicate the location(s) on a map attached.	Yes	No	
Is erosion evident under chain-link sections or around posts? If Yes, describe the type of erosion (rills, gullies, valleys, washouts), record approximate dimensions (length, width, depth) and indicate location(s) on a map attached.	Yes	No	
Has failure of any fencing members occurred? If Yes, describe the failure(s) and indicate location(s) on a map attached.	Yes	No	

2. Landfill Cap

Questions	Response		Comments and Recommendations
Is settlement or standing water evident? If Yes, describe the degree of settlement(s) (slight, moderate, significant), record approximate dimensions, and indicate the location(s) on a map attached.	Yes	[redacted]	
Have settlement monuments been disturbed? If Yes, describe the type of disturbance (missing, overturned, leaning, broken) and indicate disturbed monument(s) on a map attached.	Yes	[redacted]	
Is erosion evident? If Yes, describe the type of erosion (rills, gullies, valleys, washouts, slope failure), record approximate dimensions (length, width, depth) and indicate location(s) on a map attached.	Yes	[redacted]	
Is vegetation distressed or are bare areas evident? If Yes, describe the type of disorder (distressed, sparsely vegetated, bare), record approximate dimensions and indicate location(s) on a map attached.	[redacted]	No	**Some sparse and bare areas have recently been seeded.**

2. Landfill Cap (continued)

Questions	Response	Comments and Recommendations
Is any other damage evident? If Yes, describe the type of damage(s) and indicate the location(s) on a map attached.	Yes **No**	
Are obstruction(s) (brush, debris, timber leaves, sediment) interfering with the proper functioning of terraces? Outlets from terraces? Channels? Channel Outlets? If Yes, describe the type(s) of obstruction(s) and indicate the location(s) on a map attached.	Yes **No**	
Is sediment deposited in drainage channels to a depth greater than ¼ of the original channel depth (shown on the contract drawings)? If Yes, record approximate dimensions and indicate location(s) on a map attached.	Yes **No**	

3. Gas Control System

Is damage evident? If Yes, describe the type of damage (vent/well riser cover missing, vent/well riser cracked, overturned, leaning, broken) and indicate damaged gas vent/well riser(s) on a map attached.	Yes **No**	**Three vent risers are leaning slightly.**

3. Gas Control System (Continued)

Questions	Response		Comments and Recommendations
Is settlement or standing surface water evident? If Yes, describe the degree of settlement(s)(slight, moderate, significant), record approximate dimensions, and indicate the location(s) on a map attached.	Yes	[redacted]	**Slight settlement around vent risers.**

4. Surface Water Drainage and Erosion Control System

Is overall shape, configuration, and alignment of the drainageway as shown on the drawings? If No, describe the type of distortion (damaged, eroded, slope failure), record approximate dimensions and indicate location(s) on a map attached.	[redacted]	No	
Is erosion evident? If Yes, describe the drainage structure inspected (channel, culvert, outfall, gabions), the type of erosion (rills, gullies, valleys, washouts, slope failure), record approximate dimensions (length, width, depth) and indicate location(s) on a map attached.	Yes	[redacted]	

4. Surface Water Drainage and Erosion Control System (Continued)

Questions	Response	Comments and Recommendations
Is settlement or standing surface water If Yes, describe the drainage structure inspected, the degree of settlement(s) (slight, moderate, significant), record approximate dimensions, and indicate the location(s) on a map attached.	Yes **No**	
Are obstruction(s) (brush, debris, timber leaves, sediment) interfering with the proper functioning of drainageway or the stability of adjacent embankments? If Yes, describe the type(s) of obstruction(s) and indicate the location(s) on a map attached.	Yes **No**	
Is sediment deposited in drainage channels or culverts deeper than ¼ of the original channel depth (shown on the contract drawings) or culvert diameter? If Yes, record approximate dimensions and indicate locations on a map attached.	Yes **No**	
Is structural damage evident? If Yes, describe the type of damage (upheaval, cracking, undermined, overturned, fractured, broken) and indicate damaged structure(s) on a map attached.	Yes **No**	

4. Surface Water Drainage and Erosion Control System (Continued)

Questions	Response	Comments and Recommendations
Have stones been dislodged at rip rapped drainage outlet aprons? If Yes, record approximate dimensions and indicate location(s) on a map attached.	Yes **No**	

5. Leachate Collection System

Are any Manholes leaking? If Yes, describe the magnitude of the leak (drip, steady discharge, single overflow) and indicate location(s) of leaky Manholes on an attached map.	Yes **No**	**Manholes 1,4, and 5 periodically contain standing water due to rain infiltration and are pumped out.**
Are any pipes or valves leaking? If Yes, describe the magnitude of the leak (drip, steady discharge, single overflow) and indicate location(s) of leaky Manholes on an attached map.	Yes **No**	
Are leachate extraction well pumps operating properly? If No, describe the malfunction and indicate the extraction well number.	**Yes** No	

5. Leachate Collection System (continued)

Questions	Response		Comments and Recommendations
Is damage or degradation evident at these system components?			
Leachate Extraction Well Manholes?	Yes	No	
Extraction Well Pumps and associated Piping?	Yes	No	
Leachate Junction Manhole?	Yes	No	
Leachate Lift Station and Lift Station Pump?	Yes	No	
Leachate Detection Points?	Yes	No	
Leachate Collection Pipe Cleanouts and Vents?	Yes	No	
Is Leachate Evident in any of the Leachate Detection Points? If yes, Indicate which one(s).	Yes	No	**1.5 Gallons removed from LD-4. May be condensate. Monitoring weekly.**

6. Infiltration Gallery

Questions	Response		Comments and Recommendations
Is standing water present? If Yes, describe.	Yes	No	
Is debris or trash present? If Yes, describe.	Yes	No	
Are strong odors present? If Yes, describe.	Yes	No	**Most well areas have distinctive odors.**
Is the 6-inch diameter perforated HDPE at the infiltration gallery obstructed? If Yes, describe the magnitude of the obstruction (75% blocked, 50% blocked).	Yes	No	

7. Access Roads

Questions	Response		Comments and Recommendations
Is pavement distress evident? If Yes, describe (cracking, pothole(s) upheaval, failed patch), record the approximate dimensions (length, width, and depth), and indicate location(s) on an attached map.	Yes	No	**Alligator cracking evident various locations along access road.**
Is erosion evident on shoulders embankments, or drainage ditches? If Yes, describe the type of erosion (rills, gullies, valleys, washouts, slope failure), record approximate dimensions (length, width, depth) and indicate location(s) on a map attached.	Yes	No	
Are culverts damaged? If Yes, describe the culvert inspected, conditions observed (spalling, cracking, exposed reinforcement, joint separation) and indicate location(s) of impacted culvert(s) on a map attached.	Yes	No	
Are obstructions present in the culverts or impacting the stability of adjacent embankments? If Yes, describe the obstacle(s) (leaves, brush, debris, timber, sediment), and indicate the location(s) on a map attached.	Yes	No	

7. Access Roads (continued)

Questions	Response		Comments and Recommendations
Is sediment deposited in culvert(s) deeper than ¼ of the culvert diameter? If Yes, record approximate dimensions and indicate location(s) on a map attached.	Yes	No	
Are obstructions present in the drainage ditches adjacent to the road shoulders? If Yes, describe the obstacle(s) (leaves, brush, debris, timber, sediment), and indicate the location(s) on a map attached.	Yes	No	
Is road access to OU2 and the treatment plant safe and efficient?	Yes	No	

8. General Comments or Observations

INSPECTOR

Ebbert B. Taylor
Typed or Printed Name

Signature

REVIEWED BY:

Jason S. Ross, P.E.
Typed or Printed Name

Signature

Kentucky P.E. No.

STATE OF KENTUCKY
JASON S. ROSS
20437
LICENSED
PROFESSIONAL ENGINEER

E 1573000

E 1572000

E 1571000

① STRESS CRACKS IN ROAD

SCALE IN FEET

0 200

REV	DATE	BY	SUB	APP	DESCRIPTION	REV	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED
DRAWN
CHECKED
IN CHARGE
DATE 6 NOV 95

SUBMITTED

SMITH'S FARM OPERABLE UNIT TWO
BULLITT COUNTY, KENTUCKY

LAW
ENGINEERING AND ENVIRONMENTAL SERVICES

APPROVED

OPERATIONS AND MAINTENANCE QUARTERLY REPORT 2nd QUARTER 2001

SCALE AS SHOWN

CONTRACT 12000-1-0006

FIGURE 1

REV 0